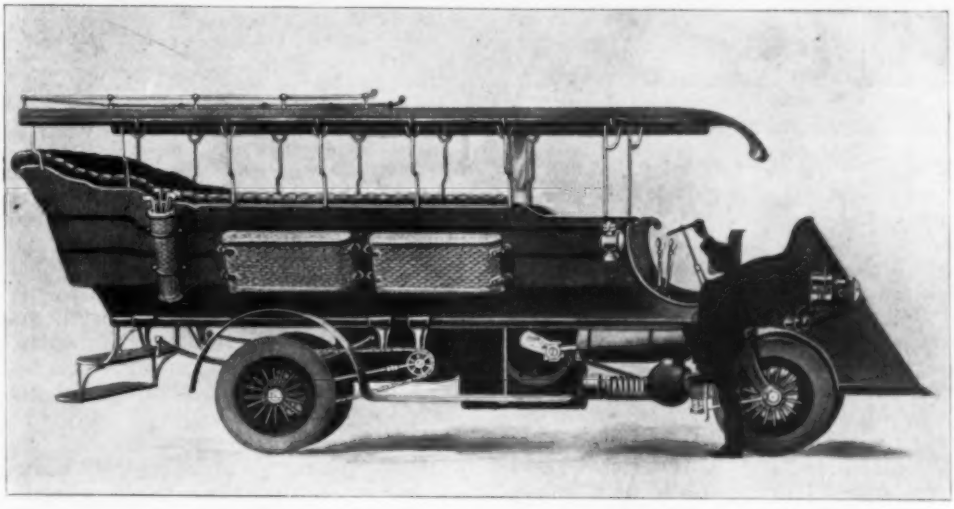
Popular Mechanics

Vol. 6. No. 7. CHICAGO, JULY, 1904. 10 Cents a copy. $1.00 a year.

Largest Automobile in the World

Has 400 Horsepower -- Is Expected To Run 100 Miles An Hour -- Cost $35,000.



The Touring Body.

The largest automobile in the world, costing $35,000, of 408 horsepower, and capable of a speed of 100 miles, has lately been built at Cleveland, Ohio.

This machine, which was built for Louis D. Schoenburg, will accommodate ten persons with separate sleeping apartments for long distance trips, besides which they may have their meals served in the vehicle, as it is provided with a kitchen and dining-room. It also carries a dynamo for electric lighting and heating. Besides being so commodious the interior appointments and decorations are rich, beautiful and luxurious.

The car has three bodies: The Pullman body described, a touring body and a racing body. It certainly surpasses anything yet attempted in automobile construction and will probably stimulate a number of competitive efforts.

Demonstration of World's Navies in 1900.

Is This Remarkable Assemblage of Fighting Forces to Be Repeated?

The Fighting Fleets of the World Assembled in China Waters in 1900

The navies of the world lay for months off the coast of China during the Boxer troubles in the summer of 1900. Side by side were the battleships of Russia and Japan, and in that remarkable cosmopolitan fleet were battleships and cruisers of the United States, Germany, France, England and Austria. The great world powers were there to enforce peace in China, and by their irresistible strength awe into submission the nation which has always received foreigners under protest.

The combined fleet numbered nearly 100 fighting ships. Owing to the shallow waters of the bay they anchored out 17 miles from shore off Taku, China. The Brooklyn, which arrived in July, was among the first to anchor and remained until October, when peace was restored and the fleet sailed away.

Is this remarkable assemblage to be repeated? Will the nations of the earth be drawn into the controversy? China is already being infected with the war fever. France has promised to aid Russia if China rises to assist Japan. If France helps Russia, then England will come to the assistance of the Japs, and when once the spark has touched the powder train none can tell where the explosion will reach.

The illustration is from a rare photograph in the possession of Geo. W. Richardson, of Chicago, who was chief electrician on the Brooklyn during the allied demonstration. The original picture was worked on silk by a Japanese artist who was on one of his country's ships.

There are thousands of unemployed workmen in New South Wales. Laboring conditions have been grossly misrepresented and many immigrants from the United States are the victims. The law gives the unions a monopoly of the work at fixed prices.

Within six months the law making Sunday a day of rest in Spain will go into effect. The only exceptions will be in cases where work is an absolute necessity and persons under 18 years of age and all women are not to be employed at all on that day.

Huge Floating Dock Takes 8,600-Mile Voyage

Constructed in an English Yard and Is Towed to South Africa --An Eventful Trip

By A. Leach Woods, Durban, Natal, South Africa

After towing it a distance of 8,650 miles over stormy seas, the English government has at last succeeded in anchoring a huge unwieldly floating dock safely in the harbor at Port Natal, South Africa. The feat is one of the greatest of its kind ever accomplished.

In charge of two sturdy tugs, the huge structure, 475 feet in length, 96 feet 2 inches wide and with a lifting power of 8,500 tons, day by day, surely, safely, made the trip across the thousands of miles of ocean expanse, and in conveying her, 24,000 tons of coal were consumed, 18,000 tons of this enormous quantity being bunkered on the dock itself and 600 tons being carried by the tugs, which renewed their supply at various points.

The Floating Workshop on Board the Dock

The great increase in importation at the Natalian port caused the colonial government to obtain a thoroughly up-to-date floating dock, with workshop, and one that would in every way be capable of meeting any calls that might be made upon it and the requirements of the port generally. An order was therefore placed in September, 1901, with the firm of Messrs. Swan, Hunter & Wigham-Richardson, Ltd., of England. This dock eventually left England in tow of the S. S. "Baralong" of the Bucknall line of steamers, but after a successful voyage and when only about 720 miles from her destination, during a strong wind, she broke away from her escort and went ashore off Mossell Bay before anything could be done to save her. Several unsuccessful attempts were made to re-float her and ultimately she was abandoned. The unfortunate

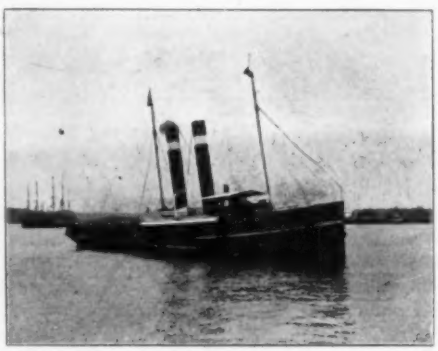
Watching the Towing of the Dock Into the Harbor

loss of this dock, necessitated ordering a second, which was launched at Wallsend-on-Tyne on August 8, 1903, from the yard of the builders of the former one. This dock at the order of the government was made some 100 feet longer and of about 4,000 tons greater capacity than the original one, and in the comparatively short space of six months the English firm of builders completed the great engineering work.

The launching ceremony was performed by Mrs. Tatham, the wife of Mr. F. S. Tatham, K. C., M. L. A., of Pietermaritzburg, Natal, on August 8, 1903, the dock being christened "Sir Walter" after the Agent General for Natal, Sir Walter Peace. The dock, after undergoing a few trials on the Tyne, left for Port Natal, on September 16, 1903, and arrived safely on the 8th of February, 1904; after a voyage of over 8,000 miles. No small credit is due to the captains of the two Dutch tugs which successfully towed this huge structure over so many miles of sea. The captain in charge of the dock was Captain Verschoor; the tug "Zwartezee" (542 tons gross) had as its skipper Captain Post, and Captain Koenes was responsible for the "Oceaan" (387 tons gross). With the recollection of the fate of the previous dock, it is not to be wondered at that the progress of this one, across the thousands of miles of ocean, was watched most anxiously by all Natalians. It was, however, not without incident that this huge structure reached its destination, the most southerly port of South Africa.

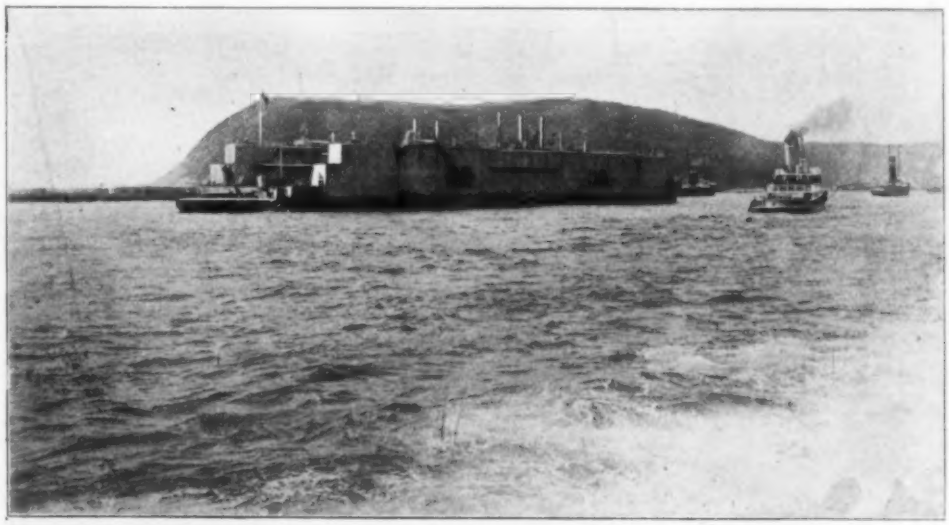
After leaving the Tyne, a good wind prevailed until Portland was passed and then the rough weather which was experienced after crossing the "line" snapped the towing hawsers, causing her to drift a considerable number of miles out of her course and at the same time placing her in danger of foundering. Fine weather was the order from the island of Maderia to St. Thomas where the tugs called for coal. From that spot to Walfisch Bay the atmospherical conditions continued to be all that could be desired. On December 22nd, however, terribly rough weather was encountered. The towing rope of the "Zwartezee" broke, catching on the propellor and the sister tug was left single-handed to hold the bulky craft until her helpmeet could obtain connection again. This, however, proved too much for the "Oceaan," which was ultimately obliged to let go of her charge. Consequently the dock began to drift and 24 hours elapsed before the tugs had finished chasing the dock and become again attached to the runaway; it was then ascertained that the massive structure had drifted a distance of 80 miles! The captain of the dock, however, was not seriously alarmed at the state of affairs, knowing that the tide would carry them away from the shore. The weather from the date of this exciting adventure—an adventure which the captains stated very materially helped to relieve the monotony of the voyage—to Capetown, caused no anxiety. At that port they called for coal and provisions, remaining a fortnight for this purpose. The worst part of the whole voyage was from this latter port to Durban, for not only was the weather bad, but the current was against them the whole way. The distance is 818 miles and it took 17 days to cover this remaining portion of the voyage. The actual distance sailed was 8,650 miles—that is, including the distance covered when the dock broke away and drifted.

Perfectly equipped for her work, the dock,



The Dutch Tug "Zwartezee" in the Harbor, Port Natal

which is 70 feet between the guard timbers on the side walls, can accommodate vessels up to 68 feet beam, and, while still retaining a freeboard of 4 feet 3 inches, can take a vessel drawing 23 feet over keel blocks 4 feet high. The dock proper consists of three pontoons and two side walls, to which the pontoons are connected by means of movable joints, so that any of the pontoons when required can be removed and lifted by the dock itself, thus making it self-docking in all its parts. The machinery is contained in the upper portion of the walls and consists of two separate but



The Floating Dock Entering the Harbor, Port Natal--Passing the Lighthouse

indentical installations. Each installation comprises two boilers and two pumps, each pump being driven by its own engine, and the piping of the dock is so arranged that either pump can empty the whole of the compartments on its side of the dock. Besides this there is communication through the central bulkhead across the dock so that in case of a breakdown it would still be possible to lift the dock by the engines of one side alone. The boilers are of the ordinary return tube marine type, 10 feet long by 8 feet 6 inches diameter. The engines are of the horizontal compound type, placed on their sides and connected directly to the vertical spindle of the centrifugal pumps, which are placed at the bottom of the dock, directly on top of the main drain of the pumping system, the weight of shafts and pump impellers being taken on ball bearings at the engine deck. The dock itself is divided into 44 watertight compartments, each of which has a separate pipe leading into it, each pipe being provided with its separate valve. All these distributing pipes are collected into the main drain, on which the pumps are seated, and the discharge and inlet into this main drain are governed by large screw-down valves, and by automatic flap valves outside the dock. The different compartments are all worked by means of bell cranks and rods and levers from the valve house placed centrally on each wall, so that the valve man has complete control over the whole of his section of the dock. As regards fittings, the dock has 46 sliding bilge blocks, which can be hauled in under the vessel by means of chains from the top deck. It is further provided with four mechanical side shoes by means of which a vessel can be centered on the dock. Four steam warping winches, two on each wall, are provided for hauling the vessel into the dock.

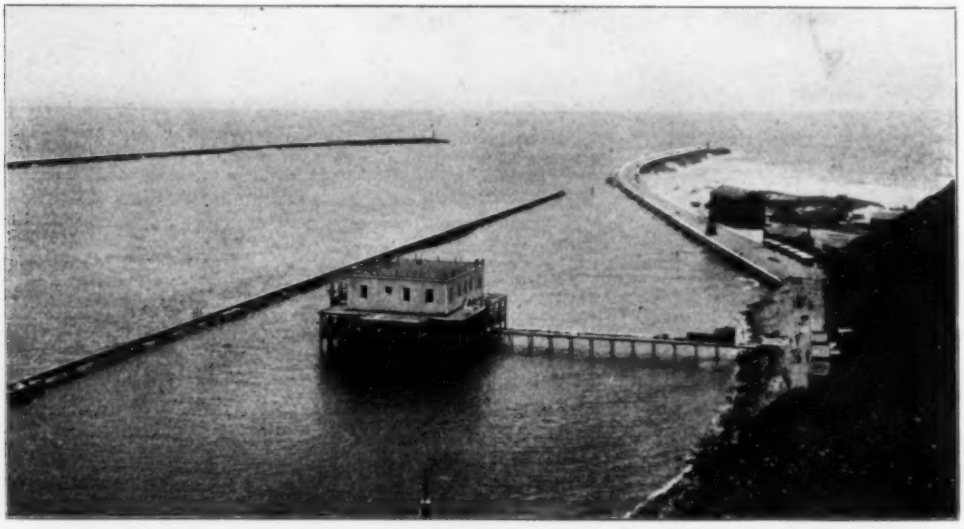
In addition to all the ordinary requirements of a dock, the present one is provided with a very complete electric installation which will enable work to be carried

out on ships through all the hours of both day and night. This installation which is situated in one of the walls is of a marine type boiler and two steam dynamos, duplicates of each other, and by means of a flexible cable the current is conveyed across the dock to the other wall where it is connected to a switchboard from which the different services emanate.

The lighting installation consists of three circuits: first, there are the standard 200 candlepower lamps along the top of the walls, these light the dock generally; secondly, there are a series of clusters of lamps in reflectors, which can be carried to any part of the dock or ship on dock, where

To fully appreciate the dimensions of the dock it is necessary to go on board. Upon entering the structure the first idea is which way to turn. Tiers of ladders lead from the dock's bed to the upper bulwarks and are bewildering to the uninitiated; however, when the uppermost level is reached, on either side are found compartments for the crew, engine and machine regulators, steam winches and with the necessary lifeboats fully equipped.

But, perhaps, the most important and interesting feature of the equipment is the floating workshop which was brought out on the dock and has been constructed to meet the requirements of steamers and



Entrance to the Harbor, Port Natal--View From the Lighthouse

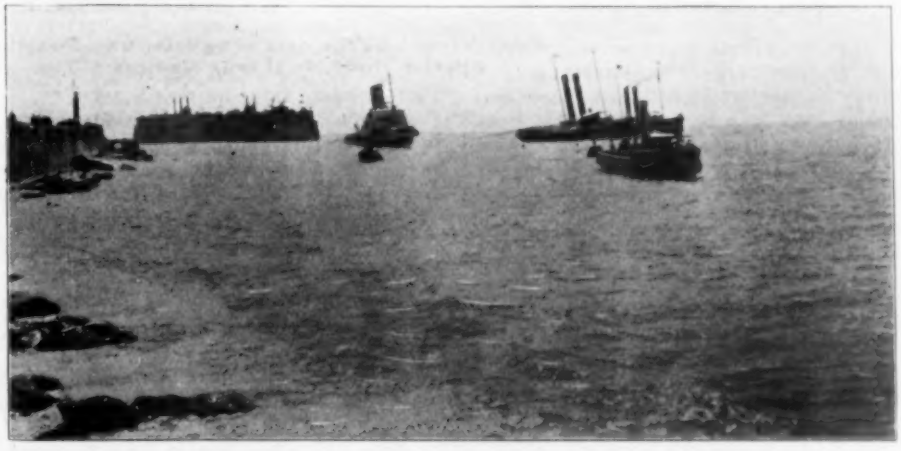
light may be required; and, lastly, there are the ordinary incandescent lamps in the boiler, engine and store rooms and other compartments of the dock. The electrical installation is of sufficient power to enable electric drills to be taken off from the plug boxes for carrying on work on the hulls of ships for which purpose it is possible to utilise both the steam dynamos simultaneously. The system used is the direct current, 110 volts, the electric cables being all contained in steel tubes, with the exception of the cable crossing the dock and which is drawn into lead and suitably armoured, thus showing how carefully every detail of this huge floating structure has been considered.

other vessels needing repairs. Being self-propelling it can, if desired, steam straight to the vessel with rapidity, and without delay. In length she is 129 feet 3 inches, and her width inside the rubbing fenders is 40 feet. She has two screws, each of which is driven by a compound surface condensing engine, with cylinders 12 inches and 26 inches by 15-inch stroke; and her mean speed, on trial, was 7.12 knots. A marine type boiler supplies the steam at 130 pounds pressure. In spite of her bluff shape the vessel is very handy and steers remarkably well. The rubbing fenders permit her to approach other crafts without doing them harm by contact.

On the deck the workshop is erected. It

contains the following machine tools and appliances: A screw cutting gap lathe, 10-inch centers and 15-foot bed admitting 9 feet 6 inches between the centers and 3 feet 4 inches by 12 inches in the gap; a shaping machine, having a maximum stroke of 18 inches, and a table 6 feet long; a double-geared drilling and tapping machine and a 5-foot radial drilling machine. A 300-pound steam hammer, on a special foundation, has also been supplied and a punching and shearing machine. The machine will push 1-inch holes in 1-inch steel plates and shear plates of the same thickness, angles, etc. There are also two fixed smith's fires and a portable one and a slab storage and another hatch gives access to the machine shop. The latter is well lighted by swing windows and there is a large opening covered by an awning in the roof. As at times it will be necessary to keep a staff of men on board, accommodation has been provided for six Europeans and 10 natives. There are six sleeping bunks on each side of the vessel, and the necessary galleys, stores, etc. Thirty-eight tons of coal can be carried in the bunkers on either side of the boilers, and the fresh water tanks hold from 18 to 20 tons.

The floating workshop which has created as much interest as the dock itself promises to justify its existence at the port. A week



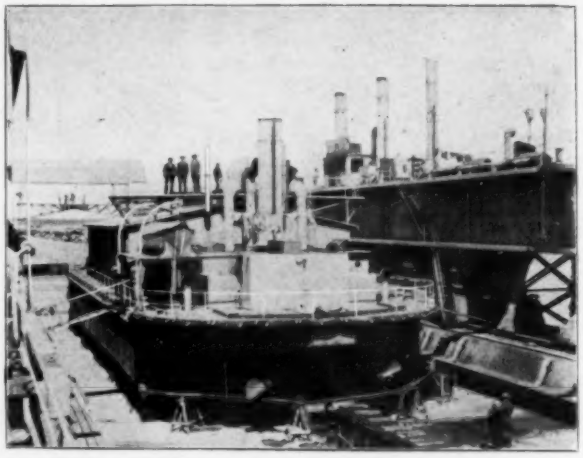
The Floating Dock Crossing the Bar at Entrance of the Harbor--Two Dutch Tugs (White Rings Around Funnels), Assisted by the Government Tug "Sir John," Towing the Dock In

for levelling. A 3-inch pipe screwing machine is also found on this commodious workshop. The tools are driven electrically by motors and a reserve of 10 horsepower has been provided for driving any tools that may be added at any future time. The vessel is lighted electrically from the same generating plant. There are six motors, one to each machine, only the blast fan and the grindstone being belt-driven. Situated at the forward end of the craft is a 40-ton cantilever crane, with a span of 40 feet. Besides its special use in repair work, it should prove invaluable for many jobs in the harbour or even outside. Behind the crane is a hatch leading into the hold of the vessel, which affords ample space for

after the arrival of the dock, the workshop was successfully floated off, the dock being partly submerged for the purpose and its off-spring now lies close by awaiting its first call to duty.

The seaport of Natal is Durban, and, excluding Delagoa Bay, which is not in British territory, it has one of the finest harbors in South Africa. Its population is about 60,000 and like most colonial towns it is of large dimensions, its area being 10 square miles. Natal is essentially an Englishman's colony and to the energy, confidence and enterprise which this fact implies, may doubtless be accredited the remarkable trade progress which it has made. Ten years ago the imports of

merchandise into Natal were valued at more than two and a quarter millions sterling annually. Last year, however, the value of the imports entering Natal amounted to $75,327,270, or nearly a sevenfold increase during the decennium. During the first half of the decennium the imports were at the rate of $21,533,500 per annum; during the second half they were $49,629,500, or considerably more than double. The total for the year, compared with 1902, showed an advance of $8,740,045. As much as 98 per cent of the total represented goods from oversea, being the extent to which America, Europe, Australia and a few Asiatic countries are benefited by Natal, either as an actual consumer or as as intermediary for inland colonies. Natal's trade budget is such that the colony may well be proud of it and the fact that the rapid progress which the country is making will tend to make these results in future years seem small, adds rather than detracts from its significance.



Near View of Floating Workshop in Position on the Dock as it was Brought Out

Already there are several ships waiting to make use of the new dock, and as soon as it is handed over, there is every likelihood of a continual demand for its services.

Motor Bus to Compete With Street Cars

Pittsburg to Have a Trackless Tramway Service

Pittsburg is to have a new auto passenger and freight service, which will start up with 40 vehicles operating 35 miles of lines. Pittsburg's bad street car service gives the company a good field and the people are quick to avail themselves of the opportunity to ride long distances for five cents.

The Liberty lines in the Squirrel and Morningside districts, the People's lines, East Liberty and downtown will be the first to be operated, with 15 passenger vehicles and 25 express vehicles, the latter to give hourly service if need be. Later on the freight service will be provided for.

The company plans to give four kinds of service; all transfers being free. The American, 5-cent fare, number of passengers not limited; the European, a fare and a half with a seat guaranteed; the school and works plan providing for special service at special rates for morning and evening hours only; and the club plan giving exclusive service at certain hours for any company of persons.

It is said that Pittsburg street car lines are completely in the hands of politicians and the service is as bad as any in the country. The Auto Traffic Company will operate entirely independent of these influences, which will enable them to give the long distance rate.

NEW TRIUMPH FOR THE PHONOGRAPH.

A large audience at Fort Harrison listened to a band concert given over the telephone line by a phonograph and thought they were getting the real article. The concert had been arranged for to be given by the Brewery Band at Butte, Mont., but when the time came the telephone line would not work. The manager of the telephone company settled the matter by moving his phonograph up to the telephone and the Fort Harrison audience enjoyed the evening without a suspicion.

Napkins are provided in Vienna telephone booths for wiping off the mouthpiece of the transmitters. The napkins are inscribed, "Wipe, if you please," and are changed frequently.

AUTOMOBILE TOUR TO ST. LOUIS.

Automobilists everywhere will join in the grand tour to St. Louis the coming summer, which is being organized by the American Automobile Association. The arrangements for the tour are very simple. The prospective member fills out an entry blank, giving the starting point and destination, also the usual data about his car and party and pays an entry fee of $10, which secures to him route books, and a number plate for his car. The association arranges for accommodations for garages at all stopping points so that no forethought need be given the matter. Each entrant must purchase his supplies, gasoline and oil, etc., at these places. There will be but two stops where cars cannot be stored indoors.

At each night's stop on all the divisions of the route registration books will be open until 10 o'clock at night, and those registering in time at every stop along any route will receive a certificate on arrival at St. Louis to the distance traveled and as to the running regularity of the car.

From New York there will be two main routes, one by way of Philadelphia, Pittsburg, Wheeling, Columbus, Richmond, Indianapolis, St. Louis; the other by way of Albany, Syracuse, Rochester, Buffalo, Cleveland, Toledo, Chicago, Pontiac and St. Louis. Routes from Baltimore, Philadelphia, Boston and many minor cities join these routes at various points.

Anyone wishing to procure entry blanks for the tour should apply to the touring committee of the A. A. A., 753 Fifth avenue, New York.

STREET CARS USED AS WINTER QUARTERS FOR CONSUMPTIVES.

Rhode Island's first open-air camp for consumptives has settled the question of winter quarters very satisfactorily. The Pine Ridge Camp, at Foster, R. I., opened in June, 1903, and during that summer the consumptives lived in 4-walled tents, keeping the sides rolled up except during violent rain storms. The tents cost about $15 each. An old barn was used as a dining room and a woodshed as a kitchen, and from 25 to 35 patients were under treatment constantly.

But when winter approached not enough funds were on hand to erect cabins. Persons who had lost a friend or near relative by phthisis were asked to donate money to build a cabin in memoriam. Ten cabins at $150 each were erected by this means, each

Cabin for Consumptives

cabin of yellow pine, 10 by 12 feet and surrounderd by a 4-foot piazza. Provisions were made for much light and good ventilation and a sign bearing the name of the donor was placed over each door. Two patients lived in a cabin. In severe weather

Old Street Cars as Living Quarters for Consumptives

the cabins were heated by small coal stoves.

Then the idea of using old street cars for the purpose came up. Some were donated and others were purchased at from $5 to $15 each. These were removed from their trucks, raised 18 inches from the ground, refloored and furnished for one patient, and were found to be perfectly adapted to this use, the amount of window space, the means of ventilation and the low cost all being great advantages.

Victoria Falls, with its 35,000,000 horsepower, is to be utilized for supplying electric power to a large portion of Africa. It is proposed to fix steel tubes eight feet in diameter across the edge of the abyss which makes the fall. What water forces itself through these tubes will drive a turbine and generator supplying 5,000 horsepower.

TELEPHONES AT STREET CORNERS.

Telephones at street corners, either on the telephone pole, or on the same post with the U. S. mail box, may be a future convenience of many cities and towns. Already they are in use to a limited extent, keyless stations opened by merely turning the handle, and which contain the pay station and

Street Corner Telephone at Bridgeport, Conn., on Same Post as the U. S. Mail Box.

a directory, being the equipment. Hollow iron posts allow the necessary ground wires. In some places the agreement with the company insures that, for the privilege of placing the telephones, all emergency calls, such as police, fire departments and hospitals, may be free of charge. This makes the system a public benefaction, saving time in case of fire or accident, and to an extent protecting the citizen. These stations are paying investments to telephone companies, as they require little extra wiring and cost little to maintain.

Street Telephone on Telephone Pole.--Directory and Pay Station Inside of Box.

George A. Long, in The American Telephone Journal, says there is no reason why these stations should not supersede the so-called police telephone systems now in use. Police could send in their reports to headquarters over the public stations and the blue police box would no longer be needed.

Certain it is that such a system in residential sections of cities would be of great public benefit, as it would in parks and along boulevards and roads frequented by pleasure-seekers. How often the automobilist would find it of use! How often it would save some person's going four or five blocks to the drug store or grocery!

JAPANESE IMITATE FOREIGN MACHINES.

The imitative power of the Japanese exemplifies itself in the extraordinary facility with which he counterfeits foreign trade marks and trade goods. "It would not be amiss," says a consular report, "if commercial travelers were empowered to register in Japan the trade marks of the manufacturers for whom they travel. One or two cases have come under notice where a traveler on his arrival found that the articles he represented were being freely and cleverly imitated to the great loss of employers."

Not only do the Japanese reproduce the machine of foreign manufacture with minute exactness, but they place thereon the foreign trade mark exactly as it appears on the machine.

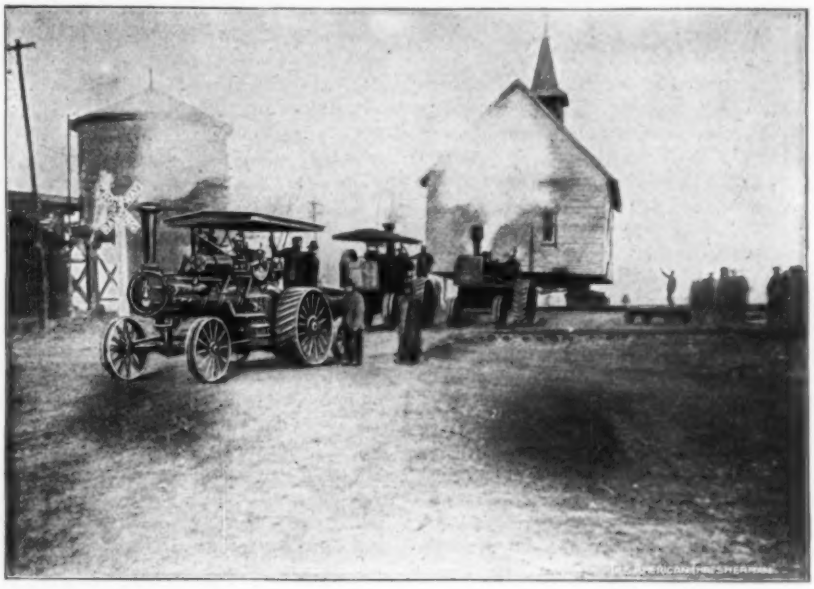
OKLAHOMA PERFORATED WITH DEEP WELLS.

Boring for water and minerals in Oklahoma has resulted in perforating the entire state with numerous wells of enormous depths. Prof. Charles A. Long of the University of Oklahoma says: "In almost every county in Oklahoma wells of more than 200 feet have been drilled. A few have been put down for prospective purposes; more, however, were drilled in search of water. In general, no water of any practical value is found below a depth of 400 feet. As a rule, water below this depth is salt. Near the base of the Redbeds, sandstones are found. Above the sandstones there is a large mass of clays and shales, then the horizon of the gypsum ledges comes in and above this is another sandstone member."

KANSAS CHURCH MOVED LONG DISTANCE.

The many moving feats accomplished lately, fully demonstrate the advance made in this line of engineering. In fact, did an entire city decide that it preferred some locality other than the one it had always occupied, it would not be impossible for it to migrate.

A Kansas church has just been moved a distance of 42 miles without even breaking a window pane. This church is 26 feet wide, 40 feet long and has a 56-foot steeple, says the American Thresher. The pulpit is



Hauling a Kansas Church 42 Miles Overland

8 by 10 feet and 8 feet high, and the vestibule 8 by 12. It required three engines of 20 horsepower each, three 1,600-pound house-moving trucks, two water wagons, one coal wagon and team, a cook-shack and 10 men, six and one-half days to accomplish the great task. Thirty-five telephone and telegraph wires were taken down and crossed, besides creeks and four railroads.

The church was moved from 23 miles north of Wichita, across Sedgwick county into Summer county. Mr. Bert Hodson, of Wichita, had the contract.

Don't forget to send for Popular Mechanics premium list.

STEEL CARS FOR NEW YORK SUBWAY.

That such catastrophes as the Paris underground railway fires and the Iroquois horror bear results in the form of life-saving devices and better fire protection everywhere is again brought to mind by the new steel cars to be used on the Rapid Transit Subway, New York.

These cars are 51 feet 2 inches long, outside of platform sills, and 8 feet 7 inches high. The present cars are somewhat heavier than wooden cars, but time will probably see a reduction in weight.

In appearance the car much resembles a first class coach. It has vestibules, longitudinal seats at each end and cross seats at the center, its seating capacity being 52. The seats are cane-covered. Very little wood is used in its construction; the inside lining and under panels are of electro-asbestos, and the head lining is of stamped sheet steel. All the mouldings are of copper. The flooring is of corrugated sheet steel covered with a monolith composition, insuring an easy tread. The capacity of its motors is 400 horsepower.

A telephone line running from Grand Central Station, New York, to the La Salle Street Station, Chicago, is the longest ever installed by a transportation company.

Telephone Engineering an Inviting Field for Young Men

How important a subject telephone engineering has become only those know who have watched the growth of a business that will before long have put 100,000,000 people into oral communication with each other. The complex character of all the work that has to do with enabling people in Missouri to call up those in Ohio or Pennsylvania has made a thorough preliminary training the first necessity to the young man who enters any of the various departments of telephony. At the Massachusetts Institute of Technology, for example, there were two graduates in electrical engineering in 1884, while today there are some 200 young men studying this one general subject and among them at least one in every six is especially interested in the telephonic courses. Yet these students, of course, represent but a small fraction of the number of future telephone engineers now training at the various schools and colleges throughout the country that have followed the institute's example in establishing courses in what is perhaps the most important of the modern "commercial professions."

It is said that already about 50,000,000 inhabitants of the United States have access to a telephone. Not all these are within the possibility of direct connection with each other; the existence of a considerable number of the so-called "independent" companies precludes that. In the course of time, unquestionably a universal system will be established linking together all the centers of population, then with present facilities anybody might count upon being able to call up, or be called up by, any other individual of the fifty millions in the district covered by exchanges.

That the business of thus securing to virtually the entire population of the United States the privileges of long distance talking is a big enough one to require all sorts of specialists goes without saying. No profession needs more thorough-going preparation. As a prominent electrician has said, "A good telephone engineer is practically all kinds of an engineer." That is to say, the man who plans to install a telephone service encounters problems that belong to the mechanical engineer, as well as others that embrace about every branch of electrical engineering.

Of course the basis of the telephone engineer's training is such knowledge of the highest mathematics as will enable him to make the endless computations necessary to the production of any plan, whether for a small induction coil or for the wires of a transcontinental system. He must know, for instance, all that is to be known about theoretical electricity, must understand the general phenomena and laws of sound, especially as they relate to speech and hearing; and, naturally, he must be expertly familiar with the details of telephonic communication and with the installation and management of great systems. These things the technical school teaches him in lecture rooms and laboratories, by endless experiments, by observation and finally by actual working experience.

The professional side of the telephone industry becomes more and more important each year, for the growth of the great network of exchanges and toll lines means not only an alarming increase in the expensiveness of the services, but also multiplication of the technical problems which only specialists can solve. A little rural exchange equipped with new apparatus and a small list of subscribers can for a time be easily run, but with the increase of business and the inevitable depreciation of the plant and the necessity for connection with the outside world, unexpected difficulties manifest themselves—usually too late for the salvation of the company. The various branches of the "Bell" organization long ago discovered that one of the first needs of a system that embraces urban switchboards of most delicate construction and worth hundreds of thousands of dollars—in the case of New York City worth millions—is to have plenty of experts always at hand. A new exchange improperly managed could be made to pay dividends of 15 per cent the first year, perhaps five per cent the second; but by the fifth or sixth year it would fall into bankruptcy.

A jeweler in Boone, Ia., has a collection of watches and clocks that date back hundreds of years and still keep time. One watch with diamond set gold works and silver case is dated 1538. A 1685 watch bears the trademark "Gray's, Bond street, 1685." A clock is dated 1687 and there are two very old clocks having wooden works in his store for repairs. All keep perfect time.

Moved a 150-Ton Steel Oil Tank Down the Allegheny

Moving a Monster Oil Tank Down the Allegheny River

Moving a ⅝-inch steel tank, 80 feet in diameter and 26 feet deep, weighing 150 tons and sunk in the ground to a depth of 7 feet, even a few feet would be a large undertaking, yet such a tank was moved a quarter of a mile down a 30-degree hill, crossing five railroad tracks inside of 40 minutes, placed on barges, towed down the Allegheny river a mile and moved 200 feet up a steep bank to its new location by the Kress-Hanlon Co. of Pittsburg, Pa.

A trench 4 feet wide and 7 feet deep was dug around the tank and 32 holes 4 feet square, 2 feet deep and 8 feet apart were tunneled under the tank and wooden blocks were inserted. Two 5-ton jacks, 64 in all, under each block raised the tank four feet. It was then underpinned with 12-inch timbers; the running timbers were securely fastened with ⅞-inch chains and by means of two horses and the necessary blocks and tackle, crabs and ropes, the tank was gradually moved. At the railroad it was lowered from a height of 38 feet to 6 feet, making a height of 32 feet, which occasioned some trouble with telephone wires, etc. When within 24 feet of the water the tank was moved on five sand barges 16 feet wide and 90 feet long, ranged alongside and held firm by ratchets and ¾-inch steel cables. The tank was rolled into position on the barges and conveyed down the river a mile and thence transferred to its new location.

The work required 24 men for six weeks.

AMERICAN-BUILT SHIP DELIGHTS SULTAN.

So pleased was the Sultan of Turkey with the new Turkish cruiser, Madjidia, built at Cramps, Philadelphia, that he has sent a complimentary telegram to President Roosevelt and a personal message to United States Minister Leishman, commending the high qualities of the American shipbuilding industry. The ship was taken to Mytilene, Turkey, by American officers and crew. Capt. R. D. Bucknam was in command, with Capt. J. Blaine as executive officer. The Sultan invited the officers and crew to visit Constantinople at his expense.

Submarine Coal Mines in Japan

Where the Great Nagasaki Coaling Station Obtains Its Coal Supply

Coal mines operated at depths of 450, 596 and 626 feet below sea level, in seams angling 35 degrees and with constant danger of the caving in of the roof and consequent flooding by the ocean is an industry which employs thousands of the Japanese and is the source of all the Nagasaki coal supply. Japan is rich in coal from Nagasaki to Yezo, but her most interesting coal mines are those located on four little volcanic islands, Hasima, Nakanosima, Takasima and Yokosima out at the entrance of the long narrow bay of Nagasaki.

Hasima Island

At Nagasaki are gathered ministers and consuls from every nation of the earth; many foreign ships enter the harbor; it is an important center of commerce and every ship that enters the harbor is supplied with coal mined at the island mines out there at the ocean's rim.

Russia has vast beds of superior coal lying undeveloped. Even for her domestic supply she is partially dependent on importation, and now in her time of need, when for her coal is a contraband of war, her navy is handicapped by having no adequate and available coal resource. Meanwhile Japan goes on mining more than she herself can consume. The relative conditions are noteworthy.

All the little islands at the entrance of Nagasaki bay, save Takasima, which is quite high and has some vegetation, are barren knobs rising from the ocean's bed. Little surface they give for carrying on mining operations and aside from the steep angle of the seams, caused by the tilt of the islands, the seams are separated by hundreds of feet of sedimentary rocks and have "faults" which cause great depressions between the islands.

On Hasima island, four seams of coal are worked, the thickest of them being 9 feet 7 inches at 626 feet below sea level. There are only two shafts for the four mines, but the workings, airways, etc., of each mine are kept separate. Safety lamps are used because of gas in the mines and ventilating

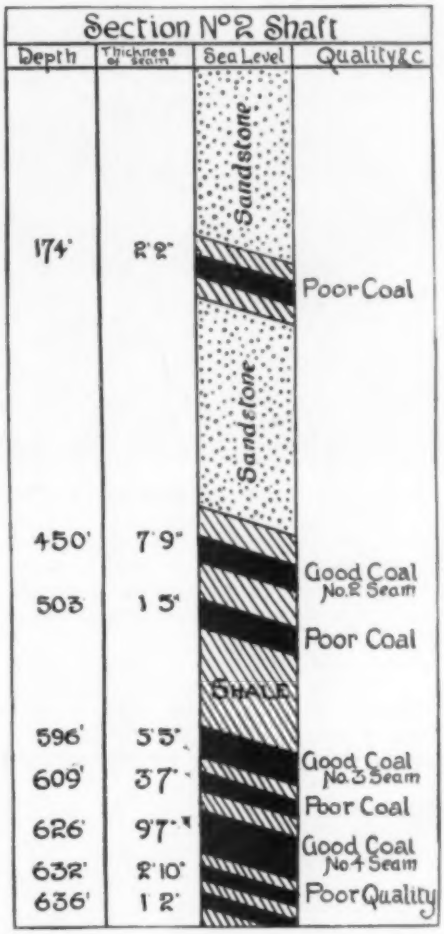
Takasima Island

fans work at each of the shafts. Shaft No. 2 is sunk 700 feet into the seam, where No. 1 level is put in along the strike. Altogether it has 23 levels, 120 feet (slope distance) apart, and the levels are connected every 100 feet by winzes, so that a plan of the mine would resemble a checker board on a slant.

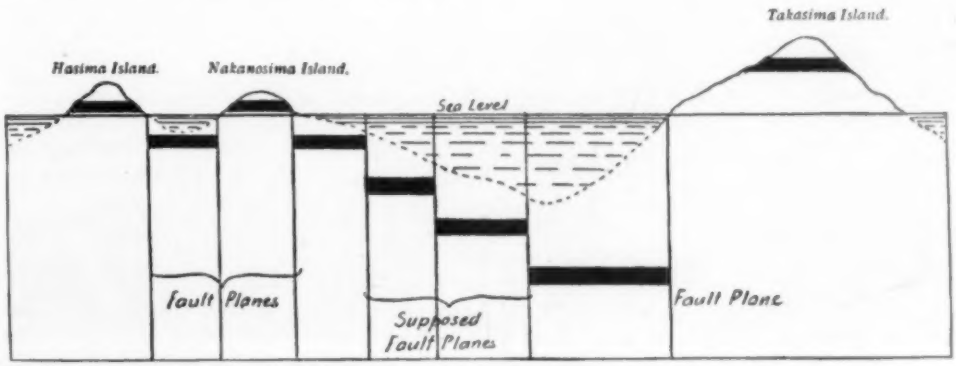
On the main incline, a double-drum winding engine works a double line of rails, hauling 10 trucks of a half ton capacity each. From the levels and winzes everything is hauled to level No. 1 and thence conveyed to the shaft where single decked cages, having two trucks, fitted with safety catches, detaching hook, etc., are hauled by a powerful double-drum engine.

There is little water to be contended with in the mines, but on account of the slope, there is much pumping to be done. From the twenty-third level five sets of Tangye pumps lift the water in five stages to the bottom of the shaft, where there are three large Worthington pumps, two for emergencies and one for use which raises the water in one lift. All pumps, winding engines, etc., are supplied with steam from the surface.

Many Japanese mines are now using compressed-air locomotives in their haulage systems. The air compressor plant is fitted with duplex high-pressure air compressors, fitted with adjustable cut-off valve gear and combined governor and automatic speed and pressure regulator so that the machine responds automatically to the varying pressures and calls for air. The air compressor is connected with the various charging stations by means of pipe of 4-inch, lap-welded wrought iron laid on the haulage floor. The air tanks of the locomotives have a capacity of 68 cubic feet. The standard working



Showing Strata and Seams of Coal



Longitudinal Section of a North and South Line Showing Fault Planes

View of Shafts on Hasima Island

pressure is 800 pounds per square inch. The auxiliary reservoir is 8 feet in length and 8 inches in diameter, with a capacity of 2¾ cubic feet. The reducing valve is placed between the main tank and the auxiliary reservoir with a heavy 2-inch pipe connection. This arrangement is for the purpose of reducing the main pressure to any pressure desired in the auxiliary reservoir, usually to 140 pounds—automatically. It is also arranged to deliver air without reduction to the auxiliary reservoir, when the main tank pressure falls below 140 pounds. The locomotive has a universal metallic coupling attached to an extra-heavy 2-inch check-valve on the main tank to fit a coupling at the charging station.

There is a difference in quality of the coal mined on the islands; some of it is quite inferior, comes under the class known

Road for Surface Transportation Between the Shafts and Shipping Wharf

as "fatty" coals, that is, smokes up things badly and is generally dirty. The Takasima coal is black, lustrous and firm, but light, and must be kept dry as it often fires spontaneously. In all the coal a very low per cent of sulphur is found and some of it yields a long rich flame and has little ash. This is serviceable steam coal and also good gas coal. Certain it is that under the unusual conditions and with the difficulties attending mining in such a locality, Japan, to the complete satisfaction of her own needs and the requirements of other countries represented at her port, has operated her under-sea mines for nearly a century.

SANITATION ALONG ROUTE OF PANAMA CANAL TO BE ENFORCED.

Mortality on the route of the Panama Canal is appalling. Every mile of work done is being paid for, not alone in dollars and cents, but with flesh and blood. Conflicting statistics on the mortality leave the question uncertain, but that it is high cannot be gainsaid. To better these conditions water works and sewerage systems for the cities of Colon and Panama are to be constructed; drainage of intervening districts is to be seen to and sanitary measures will be enforced, all this at a cost to the government of $2,000,000.

FIVE-YEAR SUBSCRIPTIONS.

In response to numerous requests the publishers of Popular Mechanics announce a special subscription offer of five years for three dollars. Address may be changed as often as desired.

The United States navy is to have three scout ships with turbine engines. The turbine engines are a naval experiment being watched with great interest, and the scout ships are a new departure in our navy, though they have been used in the British navy for some time and their services are valued highly.

If you want any kind of implement or machine and don't know where to get it, write Popular Mechanics. If you do not know the kind of tool best adapted to your needs, write Popular Mechanics and you will get information that you can rely upon.

A FOLDING BUCKET.

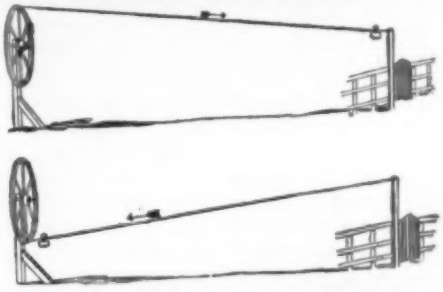
A new convenience for automobilists' outfits is a duplex folding bucket. The bucket

Collapsible Bucket for Automobilists

has a capacity of 12 quarts and when open is as stiff as an iron pail, but folds up like an opera hat, to occupy a very small space.

BRINGS THE MAIL TO THE DOOR.

A device, easily constructed, for bringing the mail from the farm gate to the house on rural routes, consists of a wheel on a stake or a tree near the house; a wire running from a point on the rim of the wheel to the gate post and a small screw wheel



Device for Bringing the Mail from the Gate to the House

pulley put into the top of a mail box and strung over the wire. The wheel is turned a half circle by means of a strong piece of cord tied where the wire is fastened to the wheel. When the wheel end of the wire is up the mail box gravitates toward the gate; when down, towards the house. Thomas P. Martin, Jr., Marlow, Indian Territory, offers the suggestion.

A fire sounded its own alarm in Terre Haute, Ind., a few days ago. The fire caught from an electric wire in a closet. There was a gun outfit in the closet and the fire exploded some cartridges; the family, awakened by the explosion, extinguished the fire.

RELICS FROM THE BURIAL MOUNDS OF NORTHERN MICHIGAN.

In the old mounds of northern Michigan are found many interesting relics. There

Found in Burial Mounds, Northern Michigan

are caskets, tablets, vases, pipes, etc., of clay; also copper arrow heads, battle axes and coins. Nobody has yet been able to read the characters inscribed on them. They undoubtedly belong to a prehistoric age. The students at the State Agricultural College have done considerable exploring and the illustration is from a photograph kindly sent us by C. E. Walter.

ALASKA NEEDS A NATIONAL WAGON ROAD.

Building the proposed great wagon road in Alaska, as recommended by the senate committee, would do more for the development of that far northern American possession than any other step that could be taken just at present. Members of the committee that made the recommendations visited Alaska last summer and made a personal investigation. It was the National road built by the United States government pursuant to the enactment of the National Road Law in 1806 that worked such an important development of the country it traversed.

Much more should a nation, now grown rich and strong, do for the newer territory of Alaska. A wagon road as good as was the old national road extending from the southern coast of Alaska to the interior could be used in the long winters and the short summers. It would put the Yukon valley in communication with Seattle and San Francisco. Over it would be carried supplies for the people already in Central Alaska and over it would go thousands of people to settle along the route or to force their way farther north.

Already the Canadian government has constructed 225 miles of good wagon roads from Dawson to the mining towns. As a result Canadian miners now pay $7.50 for 100 pounds of flour and American miners pay $18.

JAPANESE BADGES DENOTE VOCATIONS.

The Japanese army and navy officers carry the insignia of office, occupation and class plainly upon their persons in the form of

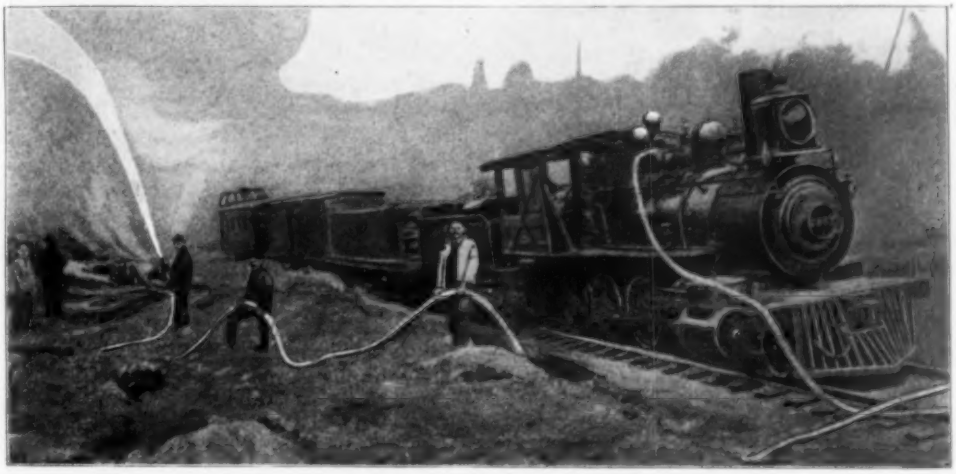
Badges Worn by Japanese

buttons or badges having a design representing each one's particular work. We show a few, most of which appertain to the navy.

During 1903 England consumed $848,937,908 worth of liquor, or an average expenditure of $20.03 for each subject in her realm. This, however, is $25,000,000 less than the record of the previous year.

New York Central's Locomotive Fire Engine.

Fully one-fourth of the fires due to carelessness in the Adirondack forests the past year were charged by the U. S. Bureau of Forestry to the New York Central's locomotives. Now their road is equipped with a heavy 8-driver locomotive with a pump which throws a large stream. The water supply is taken from some stagnant pool near the tracks beside which the locomotive, with a few cars and caboose are drawn up. The pump is connected with the pool by a hose and the train crew sent out to various points along the hose to throw the water. The steam is turned on and the powerful stream of water is played so long as the conditions will permit.



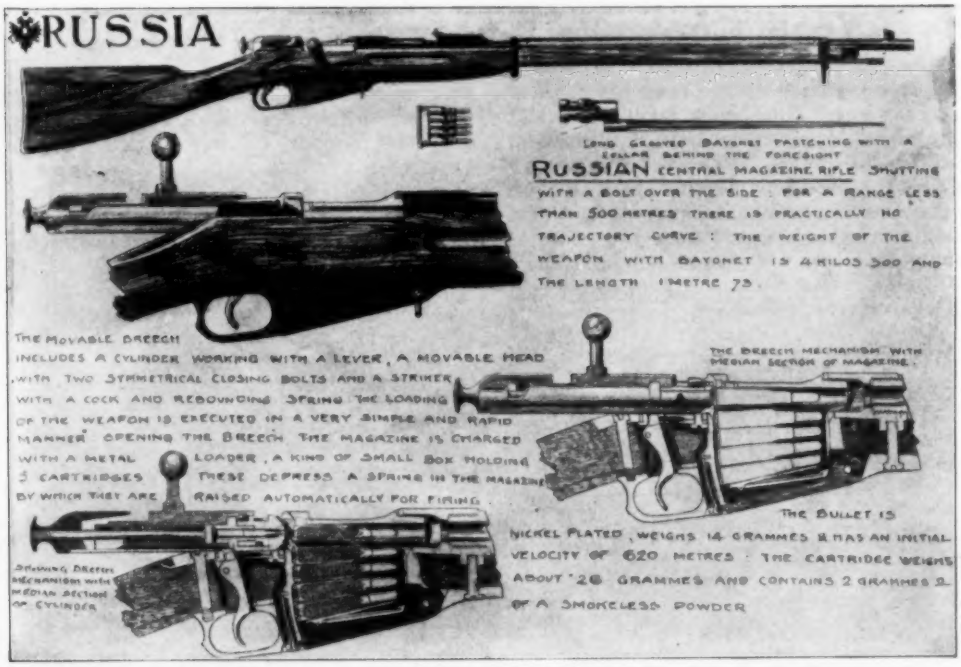
New York Central R. R. Locomotive Fire Engine.

WRITING BY WIRE A TELEPHONE ADJUNCT.

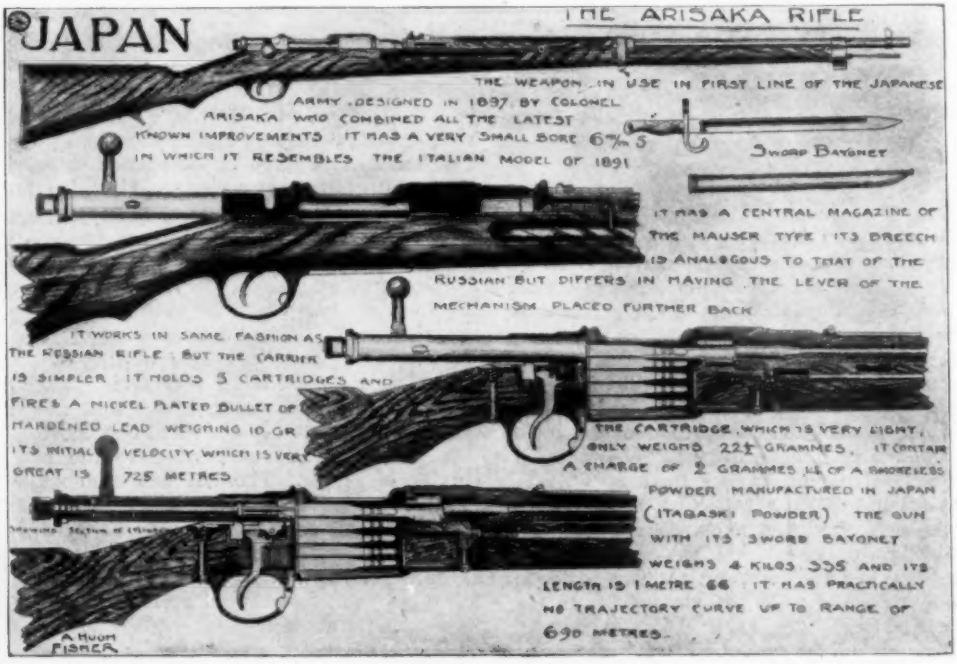
Every Wife and All Persons Must Now Learn to Use the Typewriter, or They Will Be Benighted

Here is an invention that will cause every wife and every husband to learn to use the typewriter, for now the typewriter is to be made an adjunct to every modern telephone. If the wife calls up her husband over the 'phone and he is not at his office, rather than trust someone to deliver the message to him, she simply sits down to the typewriter and dashes off the information she desires to convey to him and even as she writes, the message is being printed at the instrument on her husband's desk; it is ground off on a tape just like the tape of the present ticker machines, and is automatically duplicated on the sender's machine. When the husband returns he looks at the tape and finds the message from his wife and messages from others who may have been communicating with him during his absence.

It is a German invention and the system is called "Electric Distance Printing." So well has it worked in Berlin that plans are now on foot to have it introduced in New York and Chicago as an adjunct to all telephones. A great advantage of the apparatus is that by a simple arrangement the communication can be sent simultaneously to a number of addresses. In this manner, for instance, a person will be enabled to communicate with all the newspapers of New York or Chicago by a single writing of the message on his sending apparatus. Large industrial establishments, banks and newspapers will be greatly benefited and most of them have already subscribed to the new service in Berlin. There it has been made part of the government postoffice service. The telegraph service will also be greatly facilitated, as the main telegraph office can at once transmit all incoming telegraphic messages to any of the subscribers over the new apparatus.


RUSSIA
LONG GROOVED BAYONET FASTENING WITH A COLLAR BEHIND THE FORESIGHT
RUSSIAN CENTRAL MAGAZINE RIFLE SHUTTING WITH A BOLT OVER THE SIDE: FOR A RANGE LESS THAN 500 METRES THERE IS PRACTICALLY NO TRAJECTORY CURVE: THE WEIGHT OF THE WEAPON WITH BAYONET IS 4 KILOS 300 AND THE LENGTH 1 METRE 73.
THE MOVABLE BREECH INCLUDES A CYLINDER WORKING WITH A LEVER, A MOVABLE HEAD, WITH TWO SYMMETRICAL CLOSING BOLTS AND A STRIKER WITH A COCK AND REBOUNDING SPRING. THE LOADING OF THE WEAPON IS EFFECTED IN A VERY SIMPLE AND RAPID MANNER. OPENING THE BREECH, THE MAGAZINE IS CHARGED WITH A METAL LOADER, A KIND OF SMALL BOX HOLDING 5 CARTRIDGES. THESE DEPRESS A SPRING IN THE MAGAZINE BY WHICH THEY ARE RAISED AUTOMATICALLY FOR FIRING.
THE BREECH MECHANISM WITH MEDIAN SECTION OF MAGAZINE.
THE BULLET IS NICKEL PLATED, WEIGHS 14 GRAMMES 8 AND HAS AN INITIAL VELOCITY OF 620 METRES. THE CARTRIDGE WEIGHS ABOUT 28 GRAMMES AND CONTAINS 2 GRAMMES 9 OF A SMOKELESS POWDER

RIFLES OF RUSSIA AND JAPAN.—The Russian magazine rifle is of the old model. The Japanese rifle with its small caliber, great initial velocity and very low trajectory is essentially modern. The rate of fire of the two weapons is the same, but as regards accuracy, the Japanese weapon is perceptibly inferior to the Russian—more perceptibly in long distance and in wind—a condition caused by the fact that the Japanese cartridge weighs only two-thirds as much as the Russian. The chief difference in the two rifles lies in the trajectory.


JAPAN
THE ARISAKA RIFLE
THE WEAPON IN USE IN FIRST LINE OF THE JAPANESE ARMY, DESIGNED IN 1897 BY COLONEL ARISAKA WHO COMBINED ALL THE LATEST KNOWN IMPROVEMENTS. IT HAS A VERY SMALL BORE 6½ 5 IN WHICH IT RESEMBLES THE ITALIAN MODEL OF 1891
SWORD BAYONET
IT HAS A CENTRAL MAGAZINE OF THE MAUSER TYPE: ITS BREECH IS ANALOGOUS TO THAT OF THE RUSSIAN BUT DIFFERS IN HAVING THE LEVER OF THE MECHANISM PLACED FURTHER BACK
IT WORKS IN SAME FASHION AS THE RUSSIAN RIFLE: BUT THE CARRIER IS SIMPLER: IT HOLDS 5 CARTRIDGES AND FIRES A NICKEL PLATED BULLET OF HARDENED LEAD WEIGHING 10 GR. ITS INITIAL VELOCITY WHICH IS VERY GREAT IS 725 METRES
THE CARTRIDGE, WHICH IS VERY LIGHT, ONLY WEIGHS 22½ GRAMMES. IT CONTAIN A CHARGE OF 2 GRAMMES ¼ OF A SMOKELESS POWDER MANUFACTURED IN JAPAN (ITAGAKI POWDER) THE GUN WITH ITS SWORD BAYONET WEIGHS 4 KILOS 335 AND ITS LENGTH IS 1 METRE 66. IT HAS PRACTICALLY NO TRAJECTORY CURVE UP TO RANGE OF 690 METRES.
A HUGO FISHER

To Roll to the North Pole

Strangest Vehicle Ever Built---To Travel on the Wings of the Wind at 75 Miles an Hour

By H. N. Braun

A mammoth football, 115 feet long and 75 feet in diameter, with a seat suspended inside for the rider, is the strange vehicle in which a Chicago man hopes to journey to the North Pole. This great ball is to be rolled along by the wind, and on account of its extreme lightness is expected to go bounding over obstructions as a thistle is driven by breeze.

Peter Nissen, who attracted considerable attention in 1900 by shooting the Rapids at Niagara Falls, in an open boat, is about to come before the public again in a new role. This time he appears as an explorer and in the most novel manner, intends to explore the unknown regions of the frozen North. When I say that he intends to roll to the North Pole, very few people take me seriously, and usually look at me and ask, "What is the joke?" I will assure you that Mr. Nissen is not a practical joker, and it is with all the earnestness of a man of science that he is pursuing the object of his dreams. He is not a man of wealth, so it is not for the mere purpose of filling in leisure hours that he has taken up this subject. He belongs to the class of wage earners, and it is during his spare moments that he works, thinks and improves the child of his brain.

Peter Nissen

His last invention has been termed "Fool Killer No. 3." It is in a vehicle like this he intends to roll to the North Pole.

Already an experimental ball has been constructed and tried on Lake Michigan. This ball is 32 feet long and 22 feet in diameter. It is made of canvas and inflated with air. Through the center runs a steel axle which is held in place by numerous ropes which radiate out like the spokes of a bicycle. On this axle a boat is suspended in which the traveler sits and by sliding his weight from one side to the other he can change the course of the ball. The wind is the motive power and the speed of the ball is dependent entirely upon its caprice. When the wind comes from the wrong direction the air has to be let out

Nissen in His Ball on Lake Michigan Passing Out of Chicago Harbor

and the ball anchored. At one end is a window and at the other end is a small door that will just admit the body of a man. A contraction of about six inches takes place every time one goes in or out. On the inside there is a suction pump to be used tc replace the air that escapes and also supply the necessary fresh air for the existence of the man.

The ball is made of heavy canvas, of a fine texture, the seams being carefully sewed with silk and the outside treated with several coats of waterproof varnish.

Air Pumps at Work Inflating the Ball

The ball I have just described was built only for experimental purposes and short journeys. The advantage being that it can travel over land or sea, and with equal ease can roll over the rugged hills that obstruct the path or float peacefully on the surface of the water. The one he intends to construct for his Arctic expedition is to be much larger, being of dimensions 115 feet by 75 feet.

I asked Mr. Nissen how he came upon this idea of locomotion, and he related the following in the most interesting manner. He said: "I was studying the subject of aerial navigation in regard to its use in the Arctic region and had drawn plans of a balloon with an automobile attachment, with large pneumatic tires, probably 3 feet in diameter, or more. I proposed to travel as far as possible in the balloon and afterwards in the automobile. Since then I have studied over the idea of large pneumatic tires. I began with 3 feet in diameter and it kept growing as I saw the necessity of a larger size. This necessity became so large and the tires so large in consequence that the counterpart of the actual wheel became insignificant in proportion, so much so that it seemed possible to do without it entirely. I then thought of running a shaft through a pneumatic ball, which would make the weight rest on the shaft. The idea gradually grew until it seemed more appropriate to hang the car inside of the tire. This made me think of the auxiliary balloon and from there it was not far to the actual balloon. Think of a pneumatic tire 75 feet by 115 feet! I tell you that it would travel over a small cottage without a jar. There was still the ideas of dirigation and windows and these I have overcome and now I propose to go as far as possible in a balloon and when the lifting power is gone, and it is impossible to keep it above ground, I intend to let the gas out and move inside with boat and provisions, fill it with fresh air and wait for the proper wind and its consequences.

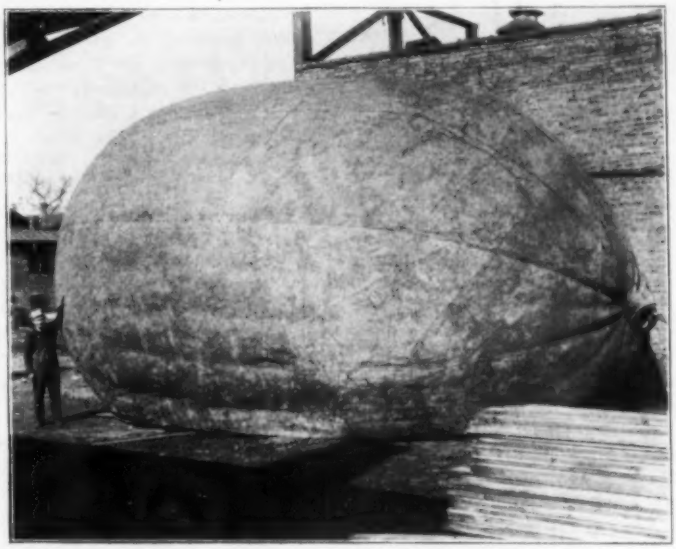
"During most of the three years that Dr.

Nansen has been in the ice he looked for high points in the pressure ridges in order to climb them to look for another ice. He says, 'On May 19th, I climbed to the top of the highest hummuck I have ever mounted. I measured roughly and made it out to be about 24 feet above the ice, but as the latter was considerably above the surface of the water, the height was probably 30 feet.'

"Now give me this balloon filled with air to the pressure of ½ ounce to the square inch; give me an ordinary Northwestern blizzard at the rate of 75 miles an hour, and I will guarantee to travel over such hummucks faster and smoother than the Empire Express on the finest track in Christendom."

Mr. Nissen has complete faith and confidence in his enterprise. On Sunday morning, April 24th, he made a trial trip on Lake Michigan very much to his satisfaction. Shortly after 10 o'clock in the forenoon Nissen arrived at the water edge, accompanied by a number of his friends whose duty it was to heave on the air pump and fill the ball with air. When the ball was inflated he climbed inside and amid the cheers of his assistants was rolled into the lake. A naphtha launch was retained to follow the ball to be at hand in case of an emergency. After running between the Chicago Yacht Club and the Columbia Club the ball made some progress on its course. There was very little wind, and the lake was as smooth as glass and the progress in consequence was slow. After reaching the pier at Park Row the ball was towed back to its starting place, Nissen still remaining within the ball. The official time for the round trip was one hour and thirty minutes; the distance about two miles. When he emerged from the ball he wore a smile of contentment, and said that if the wind had been a little stronger he felt sure that he would have rolled over the pier as easily as a baseball over a peanut.

The second trial trip was made Sunday, May 15th. On this venture it was Nissen's intention to cross Lake Michigan. A good wind came from the northwest early in the morning, but it shifted to the northeast before the time set for the start, making it impossible for him to carry out his plans, but nevertheless a small boat was hired to tow the ball out against the wind to the new pier. Here the ball was pumped full of air and while the jests of the curious, who had come to fish, were resounding in his ears Nissen entered his "Fool Killer No. 3." The ball was then towed out into the wind and set adrift. The wind blew fairly strong, but the ball showed no disposition to roll. It drifted down about a mile and a half toward the shore and was towed the rest of the way in by boat. Nissen was by



The Ball Partly Inflated

Nissen Emerging from Ball

no means discouraged and as soon as the conditions permit he will attempt his trip across the lake.

The cost of these experiments have been borne entirely by himself, as has everything else pertaining to his invention. Up to the present time he has spent about $400, and expects to spend considerable more before he has gained sufficient confidence among the people to back him up in his Arctic expedition. It is not for mere financial gain that Mr. Nissen is working along these lines. He has turned down several tempting offers from managers of amusements and shortly after his venture at Niagara had an offer of $200 a week, which he refused.

Mr. Nissen is a B. S., having graduated from the Normal School in Indiana. He has pursued various occupations, and at one time conducted a business college. He is now employed as a bookkeeper by a large manufacturing concern in Chicago. He was born in Denmark, but has been in the United States for the past 25 years and is a thorough Chicagoan.

THE DEADLY FOURTH.

The penalty of the observance of July 4th in Chicago last year was 19 killed, 314 injured and a fire loss of $103,000. The record of 10 years in 10 of the leading cities of the country is 1,110 killed, 5,593 injured and property to the value of $5,659,000 burned up. The dynamite firecracker, the toy pistol and the big rockets are largely responsible. If we must have this demonstration of noise, smoke and fire, it should be so regulated by police control that people not participating have some protection and not be put in jeopardy of their lives for 18 or 20 hours each year.

THE HANDLESS CLOCK.

At Last a Sensible, Practical Method of Reading Time

The hands on clocks of every description have been making their rounds for centuries, but now they are literally to "go," and with them the familiar dial face as well. One of the first things, and one of the hardest, a child learns, is to read time; and even when grown to mature age he is often puzzled to know whether the clock says 1 o'clock or 5 minutes past 12. All this is to be changed, the hour and minute will be read at a glance, and mistakes will be impossible. The time will be read as railroad men read it, not three minutes after 10, but "10-3." The new practical, sensible clock shows the hour at the top, and the minutes past the hour below. The hour figure changes every 60 minutes; the minute figure at the end of each minute, hence a quarter to six would read "5" in the upper panel and "45" below—5:45. For the even hour the word "o'clock" appears

Clock Without Hands or Dial

in the space where a minute later the figure "1" will appear.

For the busy man, the handless clock is worth its weight in gold. Placed on his desk it cannot fail to attract attention, and the visitor who is inclined to delay is reminded each minute of the passing time. Every 60 seconds a new figure appears, and he is made to realize how long he is remaining without even a hint from the owner who is anxious to have him get through and give others who are waiting a chance.

Japs--The Modern Spartans

Incidents and Illustrations from the Seat of War

General Sassulitch, who lost the battle at the crossing of the Yalu.

General Kuroki, Japanese hero at the crossing of the Yalu.

The Japanese have justly earned the title of The Modern Spartans.

Their daring, their utter disregard for personal danger, and the charge of their land forces into the jaws of certain death, quicken our pulses and command the admiration of the world. The days of Thermopylae; the impetuous, bewildering maneuvers of the Russian Cossacks of a thousand years ago; the patriotic sacrifices of our own countrymen in the days of '76 are all being repeated in the modern cosmopolitan soldier—the Jap.

Nor is the Russian a foeman unworthy of their steel; the rank and file have defended their positions to the last ditch and breastwork, but there is lacking on their side that patriotism which makes death for one's country a joyful sacrifice. The Russian commanders moreover have been outgeneraled week after week, and have defended where they should have attacked.

"Good-bye, and don't return alive until we have conquered." This is the last parting word with which the mothers, wives and sweethearts of Japan send their loved ones to the war.

As a troop train was leaving Moscow for the far East a few days ago, the Russian women threw themselves upon the track in front of the engine in their last desperate protest against the conscription of their husbands and sons. Sixteen times the train was started, and sixteen times the engineer applied the brakes and brought it to a stop to avoid the slaughter of frantic women. At last in a rage, the commander gave an order which the engineer dared not disobey, and the regiment was borne over the mangled, bleeding bodies of their own flesh and blood.

These two incidents dramatically illustrate the existing sentiment of the mass of the people in the two nations.

During the past month the land forces of the Japanese have occupied the place of interest, as the navy did the preceding weeks. With a secrecy never before accomplished by any nation in modern times the armies of the little brown men have been transported, landed, and marched to appear at long distances from the coast as if by magic. As the sun went down upon the Russian camps there was nothing to disturb or cause alarm. Before daylight the call to arms was sounding and the battle was on.

The ability which the Japanese officers have displayed on land and sea and the efficiency of the men and their arms has been a revelation to all the world outside of the United States and England, and has won for the little island in the Yellow Sea her place among the great powers.

The battle of the land forces on the Yalu river was a crushing defeat for the Russians. Corrected reports reduce the total loss to about 2,000 killed; but the Russians also lost 28 pieces of artillery and their position.

The battles at the Russian defenses on the peninsula, which were thrown up to protect the approach to Port Arthur, were fierce and bloody conflicts, and the exact losses in men have not yet been confirmed. The repeated charges by the Japanese up the steep unprotected hillsides, over the dead bodies of all their comrades who had gone before, and under the withering fire of rapid fire guns writes a chapter of unexcelled valor in the history of battles. These attacks lasted several days and nights

before Kinchow was taken. For the first time electric searchlights were used in actual land attacks. The Russians planted portable electric light machines at the top of the hills occupied by them, and the attacking forces were obliged to come out in the open and charge under the glare of numerous blinding lights; while the defenders mowed down the cleverly defined targets.

Dalny, the port on which Russia had spent millions of dollars, was captured and occupied by the Japs. Telegraph communication out of Port Arthur has been cut off for days and the only information from the doomed fortress is an occasional rumor brought by escaping Chinamen, or passing junks.

Cossacks in Box Car of the Trans-Siberian Railway, on the Way to the Front

At this writing the fall of Port Arthur is hourly expected. General Kuropatkin's plan to march to its relief has evidently been abandoned. While the possession of Port Arthur is of no great strategic value to the Japs, beyond relieving Togo's fleet from guard duty, its loss will be an overwhelming defeat to Russia, and will undoubtedly be made an excuse for offers by neutral nations to try to bring about a settlement between the two belligerents. Whether Russia will have the good judgment to accept these overtures is very uncertain. The Russian people would welcome it; the czar is so vacillating he one day favors peace and the next plans for a long war; the Russian officers, who are getting rich out of a war they are responsible for, want it continued indefinitely.

The Vladivostock fleet has been little in evidence, but is now reported to be in the Korean straits, where a fierce battle is raging near Tsunoshima island. The excuse for the inactivity of the Northern fleet that the harbor was closed with ice no longer holds good.

The Baltic Sea fleet is said to be getting ready to sail for the east, but is not now expected to sail before August 1st. The Sultan has not agreed to let the Black Sea fleet pass the Dardanelles.

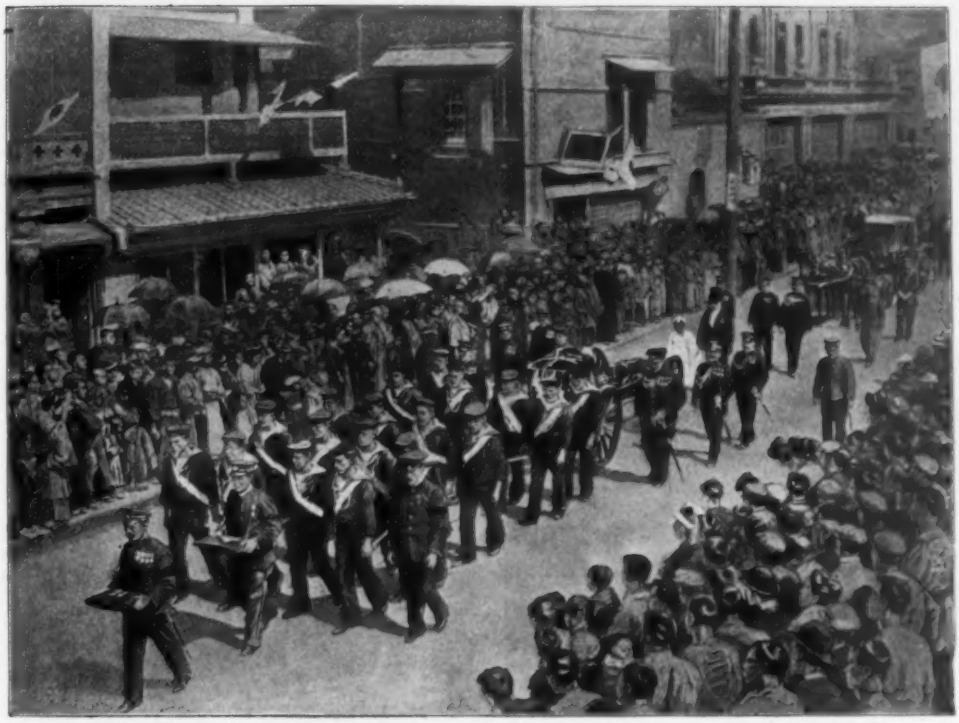
Russian Railroad Transportation.

The main line of the great Trans-Siberian railway is still in working order, and men and supplies are going east with more regularity than at first. The ice went out of Lake Baikal on May 16 and the two big ferries are now making regular trips. The ice railway across the lake which cost $250,000 has been taken up, although portions of it were lost in the break-up.

The Russian troops are transported in ordinary box cars, with openings cut for windows, and wooden bunks built across the car. Horses ride in the same car as the men. A small stove is set up at one end of the car on which is the inevitable samovar, constantly steaming with hot water for tea. The men make the best of the crude conditions, and pass away the time with music and singing the national songs. The favorite instruments are the accordion, tambourines and sharp-sounding cymbals.

The expected wrecking of the road has thus far been prevented by the vigilance of the track riders, who frequently pass over every foot of track on the eastern division.

A short time ago the Norwegian steamer "Fortuna" sailed from Bridgeport, Conn., carrying with her the American-built submarine boat "Protector" and two experts from the boat's crew. It was supposed that Japan had purchased the boat.



Funeral of Commander Hirose, Killed While Trying to Save a Comrade in One of the Attempts to Block Fort Arthur

Funeral of Commander Hirose.

Commander Hirose, who lost his life under circumstances of peculiar daring, while trying to blockade the entrance to Port Arthur, was accorded a grand military funeral at Tokio. He was struck by a bursting shell, and the only portion of his body which was recovered was no larger than a penny. In the procession two officers at the head carried his medals and decorations. Next followed bluejackets drawing a gun carriage bearing the casket; then his niece, and another relative in evening dress.

Cossacks Patroling Coast to Sight Jap Torpedo Boats

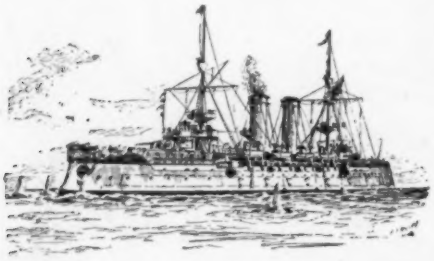
Cossacks Patrol Beach.

A constant patrol of the beach is maintained at Port Arthur and along the adjoining shore. For this work mounted Cossacks are detailed. They are constantly on the alert, night and day, watching for the approach of the Japanese torpedo boats. When the enemy is sighted the Cossacks ride at full speed to Port Arthur and give the alarm.

Japanese Naval Losses.

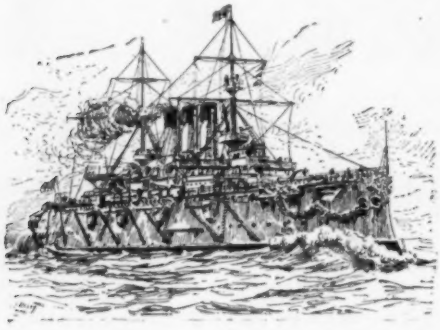
During the past month Japan has received its first serious naval loss in the destruction of the fine battleship Hatsuse, which was blown up by a floating mine 10 miles out at sea. The cruiser Yoshino was rammed by one of its own fleet during a fog.

The sowing of floating mines by the Russians is likely to call forth a strenuous protest by neutral nations, whose merchant craft are thus put in great jeopardy. These



The Japanese Cruiser "Yoshino"

mines are set adrift and, carried by ocean currents, are liable to do their deadly work hundreds or even thousands of miles away, and months after their release. Floating mines are buoyed to float a few feet below the surface of the ocean; two of them are fastened together by manilla rope. When a vessel passes over or near the mines the



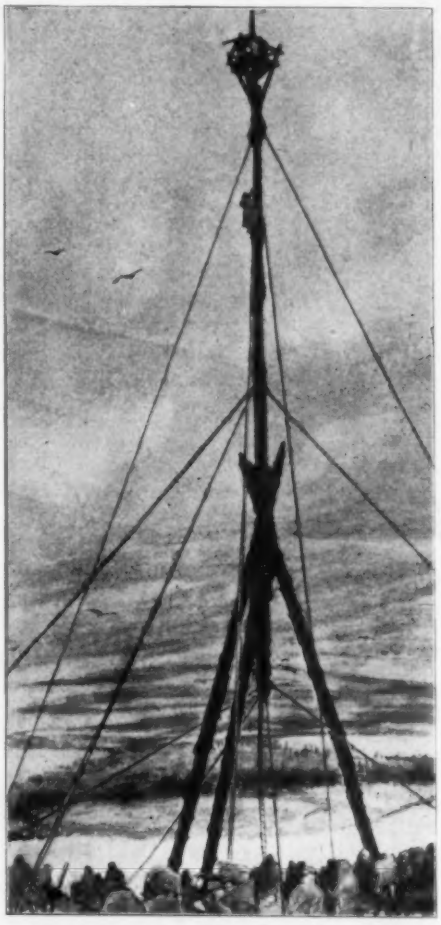
The Japanese Battleship "Hatsuse"

rope is drawn into the propeller, which draws the mine up until it strikes the hull of the ship and explodes.

The Hatsuse was built in England in 1899; was 400 feet long; displacement, 15,000 tons; horsepower, 15,600; coal supply, 1,690 tons; speed, 19 knots. The Yoshino was 360 feet long, with 15,700 horsepower and a speed of 23 knots. She was built in England in 1892.

Field Observation Towers.

The Japanese are availing themselves of all the very latest inventions and mechanical ideas, some of which are used for the first time in actual warfare. Their mastery of the operation of wireless telegraphy has enabled them not only to use it in communications between their own vessels, but to intercept and read wireless messages which the Russians were sending. On several occasions they have been able to so work their own instruments as to render the operation of the Russian



Japanese Field Observation Tower

system useless. The field telephone has also been extensively employed. The field observation towers of the Japs are in constant use in the army. The towers are erected with spars or trees, and so proficient is the training of the corps they can erect a tower 100 feet high in an hour or less. It carries an observation platform or crow's nest at the top, from which the intrepid lookout reports by telephone to his officer below. A rope ladder is used in making the perilous ascent.

Hospital Work.

The Japanese soldier is said to fear death less than any fighter in the world, nevertheless the Red Cross work is splendidly equipped and managed. There is a fine Red Cross hospital at Tokio and two hospital ships. The field corps are well trained and have won great praise for their care and attention to the wounded.

The Russians have had much longer experience in military surgery, and the Red Cross work is one of the few things which has enlisted the sympathies of all classes. An interesting feature of this field work is the use of trained dogs to draw an ambulance. Large numbers of these dogs have been sent to the front.

The Splendid Work of the Japanese Red Cross Society

Electric Railroad Tricycle.

A large number of tricycles, for the use of officers, have been built for use on the government railways. The machines carry one person, are operated by electric motors driven by storage batteries, which are carried in a closed box.

Electric Railroad Tricycle Inspecting the Trans-Siberian Railway

Searching for Victims of the "Petropavlovsk" Disaster.

One of the saddest tasks which has fallen to Russian sailors and soldiers during the present war is the search for the bodies of comrades who went down in the appalling disaster to the "Petropavlovsk."

A Japanese squadron had been sighted from Port Arthur and the Russians immediately pursued them. But Japanese strategy, which has become the marvel of nations, had reinforcements near and when about 15 miles out, the Russian vessels, closely pursued, were forced to put back toward port. While entering the roadstead and only a mile out, the "Petropavlovsk" struck a mine and sunk, carrying with her more than 600 men, among them General Makaroff. Since then the shore is constantly scoured for bodies of the victims. Many have been recovered and buried with military honors.

While by no means so terrible, a similar accident befell the Japanese recently while they were making their ninth attempt to block Port Arthur. Their ship "Taihoku" was engaged in laying mines at the entrance to the port when one of the mines exploded, injuring the ship, but not seriously, killing 20 men and wounding nine.

Russian Cook Wagon Always in Readiness

Traveling Kitchen.

The Russian army, which is fed on meat, bread and tea, carries with it a portable kitchen, or cook wagon. This is in constant operation night and day. The steel boiler has a capacity of 40 gallons. The troops forage as they march, and into this boiler are thrown pigs, fowls or game which may be secured. The contents of the boiler simmer and cook as the troops march along. Hot water is always available for tea. The Russian troops in the East are said to be on half rations. The Japs have seized a fleet of junks carrying supplies for Port Arthur.

BANANA EXPRESSES.

Whenever the Chicago market needs an immediate supply of bananas, than which probably no fruit is sold in larger quantities, a through express running 923 miles on a schedule of 33 hours, leaves the New Orleans docks to supply the great city's demand. Passengers can travel only eight hours faster than the banana express' time. The express shown in the cut comprised 34 cars, carrying 438 tons of fruit.

A perfectly equipped lighthouse constantly in charge of some capable keeper will be a unique feature of the St. Louis World's Fair. It will probably be of interest to many inland people but an inland lighthouse can never equal a real one.

Prof. M. Curie, the discoverer of radium, says: "I was a veritable duffer in school. My teachers said that I was the worst scholar that ever lived."

Banana Express, New Orleans to Chicago

The Invasion of Tibet

England is Unlocking the Door to this Strange and Little Known Country

With the Himalaya mountains for their ramparts, their peculiar climate as a strong ally and animated by their native spirit of seclusion which has ever repulsed the inquisitive advances of other nations, the dauntless Tibetans are valiantly resisting the invasion of the British Mission and its steady advance toward Lassa, their traditional sanctuary, forbidden to strangers.

Firing Jingals from a Mountain Fort

So closely has the country, lying between Russia and India on the north and south and with China, to whom it is tributary, on the east, kept her own council in years past that little is known about her. Her customs, her national and industrial development, all have been religiously guarded from foreign inquisitions. In the encyclopedias little may be found concerning her. To diplomatic relations with India her authorities turned a deaf ear, although it was claimed that she frequently violated the British frontier and the complaints were loud and many. Finally, determined no longer to be ignored, Colonel Younghusband accompanied by a strong body of Indian troops under command of General Macdonald was dispatched into the interior of Tibet, across the mountain passes of the Himalayas, 130 miles from the Indian base of supplies, to Gyangtse, 114 miles from the sacred capital, Lassa.

At Guru, two days' march from Gyangtse, the intrusion of the British was spiritedly repulsed by several thousand Tibetans, who had entrenched themselves behind a wall flanked with stone sangars. The Indian troops were ordered to disperse them without arms, and the Tibetans answered with a fierce attack. The troops fired and the Tibetans were forced to flee, leaving about 500 dead and many wounded strewing the field of the conflict.

But the Tibetans were not cowed by defeat. Their priest, the Grand Lama, who dwells in the sacred city, incited them to hold intact their national and, to them, sacred right of seclusion. Deluded or not, the same spirit that stirred the revolt of the American Revolutionists, the Poles, the

Cubans, the Boers and the American Indians, kindled their spirits to the high resolve to do or die. Such a spirit smears fields with life-blood before it yields.

Tibetans Carrying Mountain Guns While on the March.

Before reaching Gyangtse another engagement, in which many Tibetans fell, was fought. But the mountain passes between Gyangtse and Lassa, which point had now come to be the objective of the British Mission, were well fortified by the Tibetans, and the camp at Gyangtse is under continual fire from an old fort or jong, 1,400 yards distant. Here they have mounted jingals, breech and muzzle-loading, and while their military training is hardly worthy of mention they have successfully held up the Mission. These jingals are 8 feet long and the balls weigh from one to three and one-half pounds. Prongs, stuck into the ground to resist recoil, form the stands for the breech-loaders. The breech-piece containing the charge is inserted; the ball is inserted into a horizontal slit in the side of the gun to keep the rear of the breech-piece in position. Some of the weapons have foresights and backsights.

Delayed as the Mission is, it is probable that some fierce fighting will take place before its object is accomplished. The climate is intensely cold in winter and very dry; the Indian army is not accustomed to these conditions. It is far from their base of supplies. Soon the mountain passes will be blocked with snow. Supplies for the present force must be hurried across. Reinforcements cannot be sent because of the difficulties of sending supplies so far for so many. The world is watching for interesting developments in Tibet.

NEW KIND OF PROPELLERS ON AIRSHIPS.

A Californian has invented a flying-machine with a new kind of propellers. The machine comprises an oblong kite-shaped aeroplane of air-tight silk canvas, containing 300 square feet, mounted over an inner and outer band, or hoop, and will serve as a parachute in case of accident to the machinery, or in descending. There are two uplifting, neutralizing propellers, one 8 feet and the other 6½ feet in diameter, and two advancing and driving, neutralizing propellers, each 4 feet in diameter. The propellers are constructed on the bicycle principle, but have an inner and outer rim, between which are fastened strong aluminum blades or fans arranged in groups of eight in the larger and four in the smaller wheels. The propellers are placed in linear sections so that when in motion they pass over different air currents at the same time, affording the results of several wheels combined in one. Their combined weight is 40 pounds and they have 56 square feet of blade surface.

The entire mechanism of the airship is fastened together around the central hub.

Rural Produce Exchange Conducted by Telephone.

"Hello, Central, I want some tomato plants."

"Buzz, buzz: All right, there you are," as the operator connected the calling phone with phone 5 H.

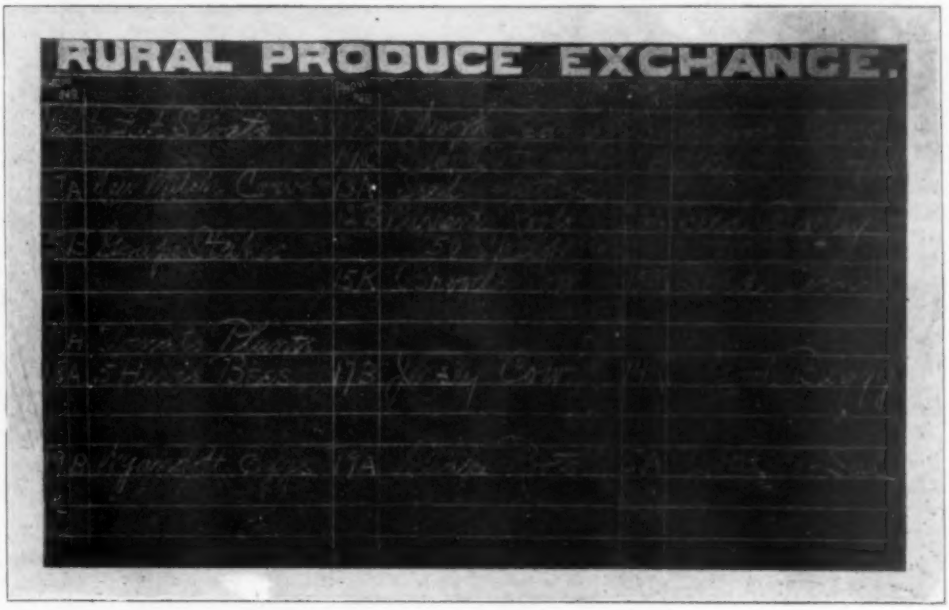
"Central? Say, I want to sell my boat. Number of my phone? It's 5 A. You have put it on the board? All right, thanks."

And that is the surprisingly modern manner in which the subscribers of a rural telephone exchange make their wants known and find things they need, without ever going out of doors and without driving all over the country.

A telephone rural produce exchange has been established in Penn Yan, N. Y., and has proven a great success, 200 new telephones having been installed on the rural lines since the execution of the idea.

Really the exchange is an information central. If a subscriber has produce, implements, or possessions of any kind for sale, he telephones the fact to the exchange and his telephone number is written on the board and the item for sale opposite it. In this way many items come to the exchange board. Then perhaps another subscriber telephones in to inquire whether there are any seed potatoes for sale that day. He is given the number of any person whose number appears on the board, as having seed potatoes. The would-be purchaser calls up the number and the chances are that the deal is consummated then and there, thus saving time and trouble.

There have been many cases where sales and purchases made in this manner have been an actual saving to the parties. The idea has done much toward making the telephone service popular among farmers and others on the line.



Quotation Board in Penn Yan, N. Y. Telephone Exchange.

HOW TO CLEANSE COPPER VESSELS.

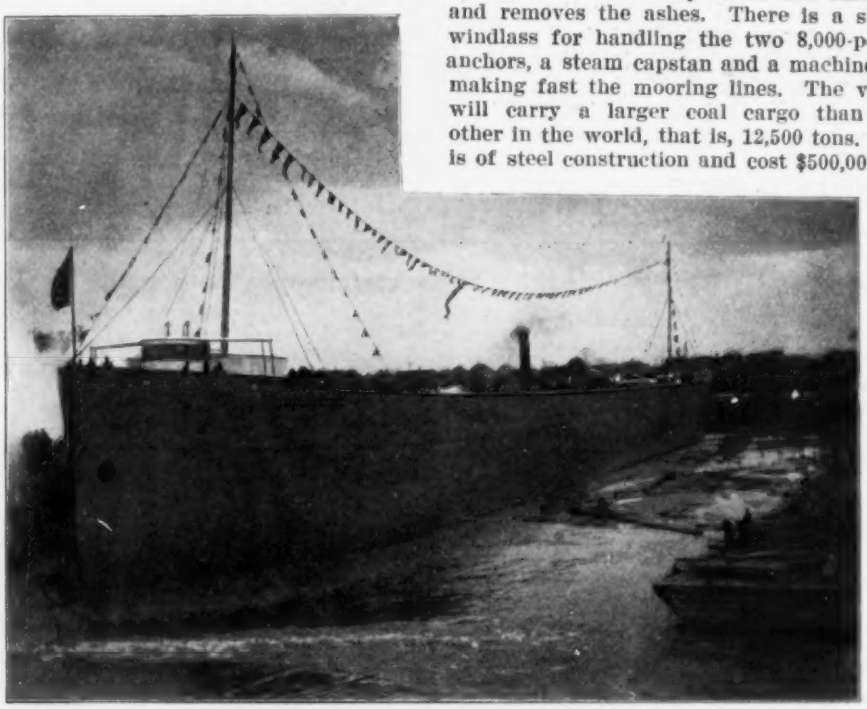
Make a stiff paste of soft soap, rottenstone and water, dissolving by gently simmering in a water-bath. Apply with a woolen rag, polish with dry whiting and rottenstone and finish with leather and dry whiting.

The center of population of the United States is six miles southeast of Columbus, Ind. The center of area of the United States, including Alaska and all the new possessions, is in northern Kansas.

Largest Fresh-Water Steamship in the World.

The largest fresh-water steamship in the world, the "Augustus B. Wolvin," is 560 feet long (62 feet longer than any steamship on the Great Lakes) and is almost automatic in its every feature. Every labor-saving device possible has been used in her construction and very few men are required in the crew, machinery taking their places. The great hopper-shaped hold is 409 feet long and has 33 hatches which open by machinery and the vessel can be unloaded quicker than any other vessel in the world and by machinery.

Automatic machinery feeds the furnaces and removes the ashes. There is a steam windlass for handling the two 8,000-pound anchors, a steam capstan and a machine for making fast the mooring lines. The vessel will carry a larger coal cargo than any other in the world, that is, 12,500 tons. She is of steel construction and cost $500,000.



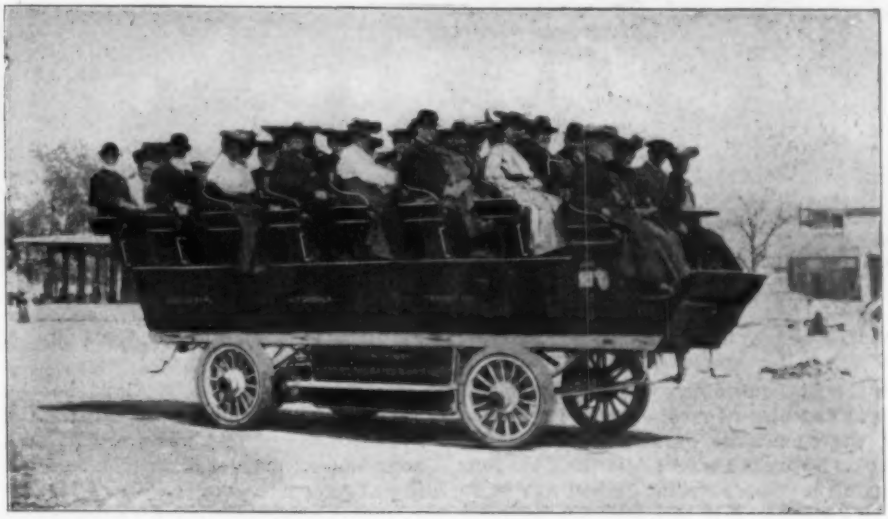
Largest Fresh-Water Steamship in the World.

THE SOUTHERNER UPLIFTS THE NEGRO.

Thomas J. Calloway, an American writer, believes that the solution of the negro problem depends on teaching the negro the mechanical arts. He says that prior to the Civil War there were many negro mechanics in the southern states. They were expert blacksmiths, wheelwrights, wagon-makers, brick masons, carpenters, plasterers, painters and shoemakers. The intoxication of sudden emancipation tended to draw the negro away from industrial pursuits. To get the negro back to the soil and to mechanical industries is the work of such schools as the one at Hampton, Va., and the one at Tuskegee, Ala.

In making a tour of 57 manufacturing plants in southern cities Mr. Calloway found 7,244 colored employes. At Atlanta colored men were found doing skilled labor in the manufacture of fertilizers, chemicals, wagons, buggies and shoes. They were generally employed in all branches of the building trades. In Birmingham, Ala., they were employed in the production of pig iron and steel, holding the responsible positions of furnace-keepers and iron graders. At Knoxville, Chattanooga and Richmond they were employed as blacksmiths, molders, puddlers and machinists' helpers. In Knoxville, Tenn., hundreds of negroes were employed in chiseling and shaping Tennessee marble.

Transportation at the St. Louis World's Fair

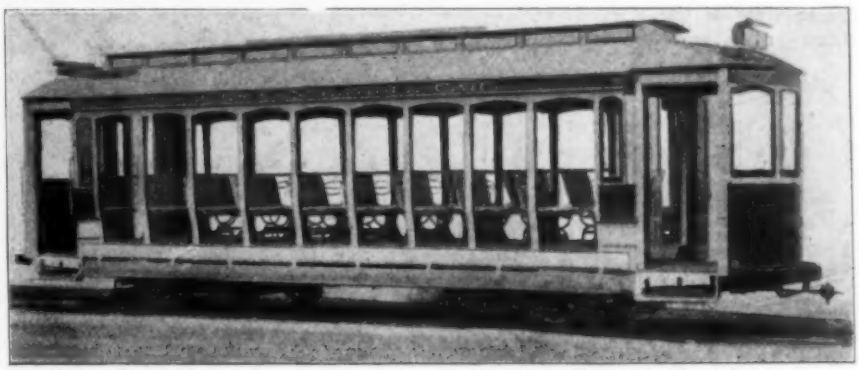


Open Electric Vehicles for Sightseers at the World's Fair.

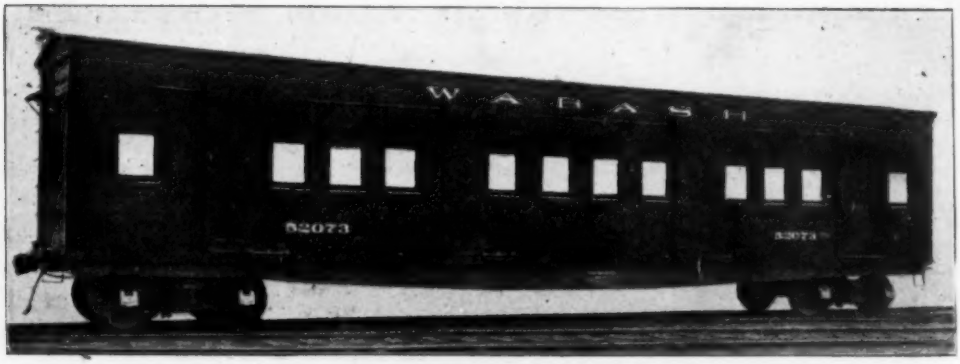
Visitors to the World's Fair this summer need have no apprehension concerning transportation facilities. Ample provision has been made by all the street car companies and every kind of conveyance imaginable is in evidence and each person may suit his individual taste. The street car lines handled the traffic successfully on the opening day and it is estimated that the three city lines to the grounds can carry 75,000 people an hour.

Probably the most efficient feature of the provision made is the flexibility of the lines accomplished by numerous terminals, so that wherever the demand for service is greatest, cars may be had to meet that demand.

Congestion at the great Union depot is to be avoided by landing passengers on incoming trains from the east, at relay depots in East St. Louis. At these points passengers can take a street car line across the Eads bridge to Third and Washington streets in St. Louis, at which point numerous lines pass, and electric cars may be taken direct to the grounds. Private trolley cars may be chartered in East St. Louis and will go through to the Fair without further change. This will afford a pleasant and inexpensive



Exposition Electric Car that can be Turned into a Closed Car in a Few Minutes.



Wabash Shuttle Car for World's Fair Service

means of conveyance for parties traveling together.

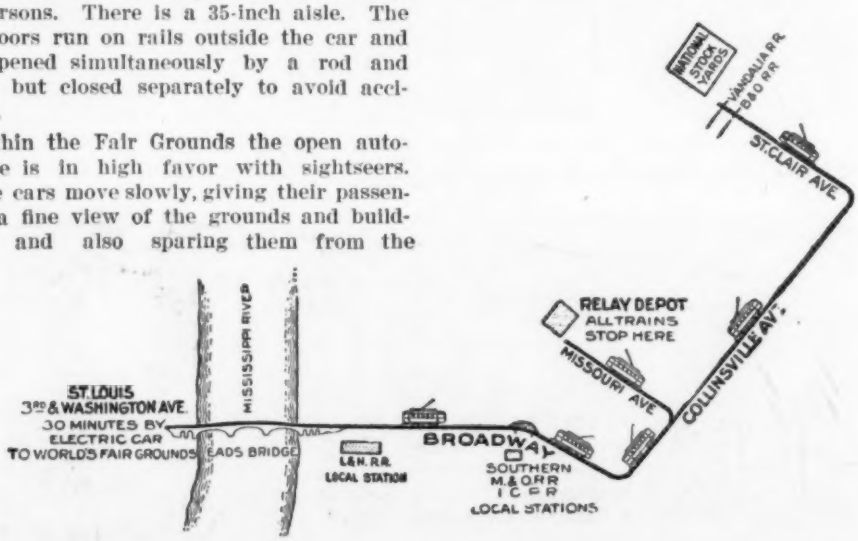
On the St. Louis lines, the usual cars will be used and also new convertible Exposition cars, the open sides of which afford a fine outlook. Between Union station and the Fair grounds the Wabash railway will run shuttle cars, of which it has had 150 built for the temporary service of the Fair, afterwards to be converted into standard furniture cars. The cars are 50 feet long inside, 8 feet 9 inches wide and 8 feet 9¾ inches high. The seats are arranged with a seat clear across the car at the end for six persons, three sets of double seats, two sets of single seats, three sets double seats and another end seat, and they will accommodate 92 persons. There is a 35-inch aisle. The car doors run on rails outside the car and are opened simultaneously by a rod and lever, but closed separately to avoid accidents.

Within the Fair Grounds the open automobile is in high favor with sightseers. These cars move slowly, giving their passengers a fine view of the grounds and buildings and also sparing them from the crowding and jostlings endured by others less favorably located.

On the lagoons electric launches having 2½-horsepower motors are in use. They have a speed of four and one-half miles an hour and form a delightful means of traveling about on the water.

Private automobiles can be taken into the grounds by paying 50 cents admission for the machine. Auto buses also leave the principal hotels every 15 minutes.

On the opening day of the Fair, the St. Louis Transit Co. carried 927,000 persons with 1,000 cars in use, the St. Louis & Suburban, 94,000 with 110 cars, and the Wabash shuttle trains 16,514.



East St. Louis Street Car Line which Will Carry People from Several Depots Across Eads Bridge to Terminal of Line to the Fair Grounds

During the World's Fair at Chicago, there were two occasions, July 4th and "Chicago Day," when vast crowds of people were waiting at 12 o'clock at night for some means of leaving the Fair Grounds. The emergency was so unexpected that the companies were not adequately prepared to handle the crowds. To hold such masses of people for a length of time is always a menace to safety of body and property.

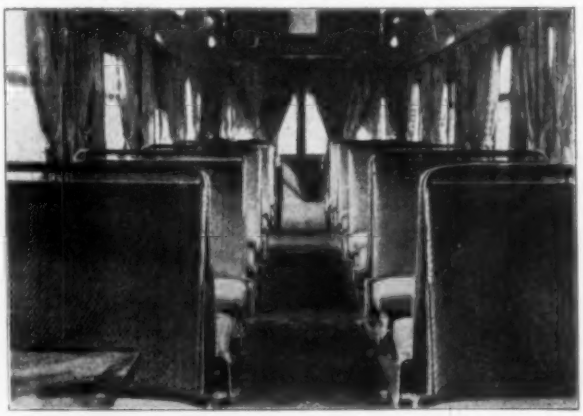
The well-stored loops at the St. Louis Fair Grounds will to a great degree eliminate a like danger. Doubtless before the Fair closes the number in attendance will be increased by many thousands over that of the opening day. At the southeast corner of the Fair Grounds is a loop which has storage track capacity for ninety cars. On the north, where there are four transit loops and two suburban, a main car yard with 500 cars in storage is only 1,500 feet from the two principal loops, to which cars can be run in two minutes, and to more distant loops in four and six minutes. Altogether there are six transit and two suburban loops and all are directly connected. So much of the visitor's pleasure and comfort depends on the transportation facilities that the extensive provisions made in this line are sure to receive hearty commendation everywhere.

Electric Launches for Carrying Visitors About the Lagoons at the World's Fair

GOING TO THE FAIR IN ROWBOATS.

While others are speeding across the country in automobiles, palace cars and Pullman sleepers toward St. Louis and the World's Fair, several little rowboats, each carrying a couple of young men, are paddling their way down the Mississippi to the same destination and their occupants are probably enjoying the most novel and wholly delightful adventure of their lives.

Two students of an Ohio university are making the trip in a 16-foot rowboat. A Wisconsin man and a friend are traveling by way of the St. Croix river and the Mississippi in a little birch bark canoe, such as the Indians used when they alone paddled up and down the great Father of Waters. A Chicago man will go in an autoboat. Two young men from Honesdale, Pa., will journey by way of the Hudson river, Erie canal, Lake Erie, the Ohio river and the Mississippi in an 18-foot rowboat, while two Chautauqua fellows start in a canoe from Cassoaga creek, travel down the Alleghany and the Ohio and up the Mississippi to St. Louis, the distance being 2,500 miles.



Trolley Car Arranged for Private Parties.—St. Louis Fair

STREET RAILWAYS IN THE UNITED STATES.

The total mileage of the street and electric interurban railways in this country is 24,561 miles. Of this, 281 miles are operated by horse cars, 142 miles by dummy engines, 267 miles by the cable, while 23,869 miles are operated electrically. On these lines are used 7,923 horses and mules; 475 steam dummies, and 52,119 electric motor cars.

First Lessons at the Forge

Every young man, no matter what his intended occupation or profession, should know something about forging, welding and shaping metals. The work is at once fascinating, useful and practical. This series of articles will extend through several issues.

PART II.—BENDING, SWAGING AND WELDING

By A. W. Marcy.

The first lesson in forming should be some simple bending like chain links, rings, hook and staples, etc. For chain links cut off six and one-half inches of ⅜-inch round iron, and heat about two and one-half inches of the center to a bright red, place the hot part over the horn of the anvil and bend to the shape shown in Fig. 1.

This may not be easy at first, but a few trials will enable one to bend them nicely at the first heat. For an S hook, like Fig. 2, cut off six inches of 5-16-inch round iron (a few short pieces of ¼ and 5-16 round iron, also ¼ by ¾ or ⅝ by 1 flat iron can be easily obtained of a neighboring blacksmith), heat half the length to bend each end. For a ring on the end of a rod like Fig. 3, bend first like Fig. 4, then bend the end to a true circle. In bending all kinds of work, heat the parts to be bent to an even heat, as uneven heats are sure to bend unevenly. A staple like Fig. 5 is made by heating each end of a piece of ¼ or 5-16 round iron to a white welding heat and drawing down to a square point, then bending the same as a chain link.

For a hook to go with the staples like Fig. 6, cut off six or seven inches of round iron the same size as staples, draw one end out to a round point for the hook, and bend each as shown in sketch. A few rings of different sizes like Fix 7 is a good lesson in bending, and they should be bent as near a perfect circle as possible.

When the young smith has mastered the principles of bending, he may take up drawing and swaging, which includes punching and splitting. Two or three round steel punches from one-fourth to one-half inch in size for punching hot iron can be obtained of any blacksmith for a few cents. Figs. 8 and 9 show two steps in drawing and swaging. In Fig. 8 one end is square and the other flat, and they are drawn over the corner of the anvil; in Fig. 9 one end is square and the other round, these are also drawn over the corner of the anvil.

The drawing should be done at a good high heat to prevent the fibers of the iron from separating and spreading apart.

When drawing a larger piece down to a round, it should be drawn square first, then the corners hammered down to make the round, as this way is easier and less liable to split the stock.

Figs. 10 and 11 show two lessons in split forging. AA are the pieces completed; BB shows how the iron is split to form the desired shape. A small hole is punched at the proper place, and the piece split open and spread apart as shown. Spread the ends apart over the corner of the anvil, and draw out to shape. Fig. 12 shows another step in forging, which is made as in Fig. 13 by swaging down the necks AA over the corners of the anvil, and drawing down the center like Fig. 12. Trim off the outside corners BBBB, Fig. 13, and round up each end over the edge of the anvil; punch the holes and it is done. Fig. 14 shows a solid forged ring without a weld, and the way to split the stock to make same. Two holes are first punched, then split as shown at A and the two sides spread apart as per dotted lines; it is then worked out larger on the horn of the anvil.

When drawing a ring of any kind, the whole ring should be red hot, if possible, as, if one side is cold, the hot portion in expanding pushes against the cold part, and does not draw so fast.

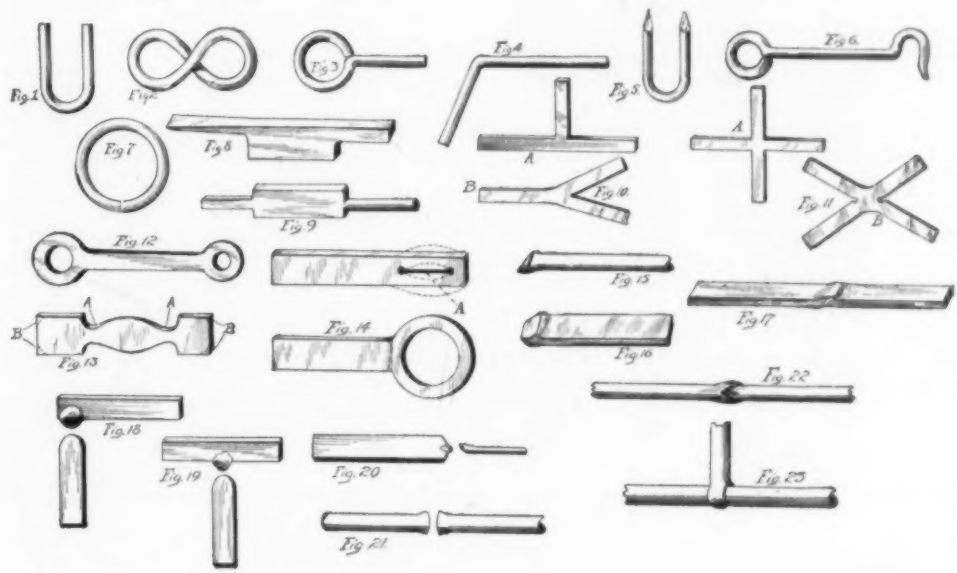
To those who have an eye for artistic or decorative iron work, twisting will be of interest. This is usually confined to square and flat shapes, although two or more pieces of round iron are sometimes twisted together. The principal requirement in twisting is care and patience, as an even, nice-looking twist requires frequent heating to get it just right. The vise and tongs are all the tools necessary for common twisting, and with a little practice the young smith will be able to make a nice-looking twist.

The next lessons are the different methods

of welding, which require fully as much judgment and skill as any of the previous lessons. Chain links and rings are the easiest to weld, and should be tried first. The chain link should be "scarfed" at the ends on opposite sides, the shape of Fig. 15, making the scarf as short as possible. A short scarf for any kind of a weld is much better than a long one, as it is easier to make, easier to heat, and usually makes a stronger weld.

The proper heat for welding iron is a soft white heat, commonly called a "snowball" heat, which should be hot enough for each scarf to drip molten iron. When at this heat, if no dirt or "dross" is between the laps, the two pieces will unite in a solid weld. Care should be taken that each lap is hot the whole length, and that no dirt sticks to the scarfs. After scarfing the chain link, bend each end together with the two scarfs well lapped over each other, heat to a welding heat and hammer together, rounding up the weld over the horn of the anvil. Welding a round ring is similar to welding a chain link, except each end is scarfed and bent in the form of a circle. Upset each end a little before scarfing to make the stock a little heavier at the weld. When making a weld of any kind, the two parts to be welded should be upset, if possible, to allow sufficient material for making the weld full size of stock.

If no allowance is made in this way, the weld will be smaller than the original size of stock, as more or less will waste away in welding, and the necessary hammering to produce a solid weld reduces it still smaller. To calculate the amount of stock necessary for making rings, multiply the inside diameter and the thickness of stock used by 3.1416, which will give the number of inches and fractions of an inch. For instance, a ring is wanted of ½-inch round iron three inches inside diameter, multiply three and one-half by 3.1416 and the answer will be 10.9956, but for common everyday work it need not be so exact, and by striking out the three right-hand figures, 10 9-10 will be the length of iron required. If a ring is made from stock bent edgeways, add the width to the diameter instead of the thickness.



The scarfing of both round and flat iron for a lap weld is practically the same, the scarfs should be drawn to a thin point, unless a very wide piece, when the end need not be very pointed, but should be quite thin. Fig. 16 shows the form of scarfs for flat pieces. When placed in the fire for the welding heat, place the scarfed side up until quite hot, then turn over and bring to a good white heat. As far as possible keep a good bed of coals under and around the pieces, and avoid letting the irons get down

in the bottom of the fire, as the cold blast will cool them off.

When ready to weld, grasp one piece with the left hand, and the other with the right, palm down, and as the pieces are pulled out of the fire, turn the right hand palm up, which will bring the scarf side up, the piece held in the left hand lapping over the other piece as shown in Fig. 17. When lapped together let go of the piece held in the right hand, grasp the hammer and weld the two together, hammering both sides alike. If the end of one or both laps does not weld down solid, take a second welding heat, which usually makes a solid job.

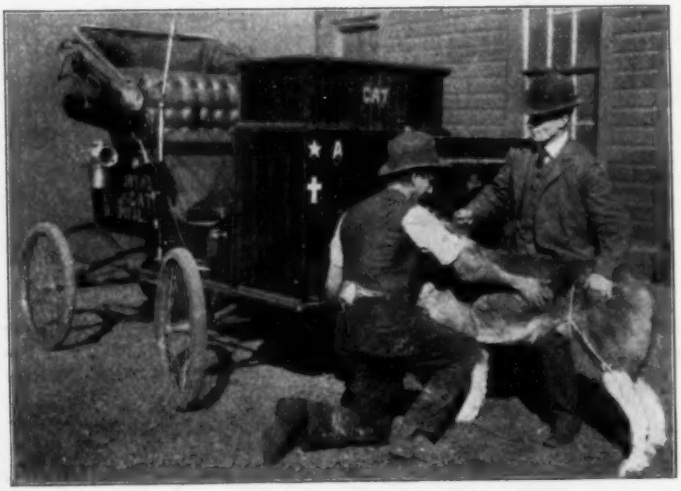
Various difficulties may be encountered in welding, but patience will overcome them; expert smiths make failures sometimes. To test a weld in a flat piece, bend a right angle edgeways of the weld, and if it does not pull apart anywhere, it is a good weld.

Fig. 18 shows the form of scarfs used in welding two pieces at right angles, which produces a square corner. Fig. 19 shows the common method of welding a T or brace in the center of a long piece; both pieces should be upset where the scarfs are formed. Fig. 20 shows the method of welding a round piece to a flat piece for strap bolts, etc. A little more skill is necessary to properly heat two pieces which are of different sizes, as the smaller piece is apt to get hot before the larger one, and they should both be the same heat to unite readily.

Large pieces of iron or steel like shafting, large bolts, etc., are often "jump welded," which is done by butting the two ends together at a welding heat. Fig. 21 shows how the ends are formed for such a weld. The ends are upset a little and rounded over to make the centers come together first; the ends are placed in the fire opposite each other, and as they are brought to a welding heat the centers are stuck together. As the heat is increased, they are driven together by striking on the outer end with a hammer or sledge. When the ends are welded solid, the weld will be considerably larger than the shaft, it is then taken out and hammered down to the required size. The object of having the ends rounding is to weld first at the center, and as force is applied to the outer ends, they gradually close up and any dirt or dross is driven out. This is the best and easiest method of welding large shafts. Figs. 22 and 23 show two methods of split welding, which need no further description. Having learned the principles of forming, swaging and welding, we will take up some useful forging in the next issue.

(To be continued.)

Automobile Ambulance for Injured Dogs and Cats



Dog and Cat Hospital Conveyance.

This automobile was especially constructed as an ambulance for injured dogs and cats. It was built for the proprietor of a dog and cat hospital at Cleveland, O. The ambulance responds to calls from all parts of the city where dogs and cats are injured. Sometimes it has as many as a dozen calls in one day. This is the first and only automobile dog and cat ambulance ever built.

The automobile is provided with an upper compartment for cats and a much larger compartment below for dogs.

Highest Dam in the World.

Stupendous Cheeseman Dam in Colorado—236 Feet High and 176 Feet Thick at the Base.

Down in the narrow, rock-walled canyon of the South Platte, in Colorado, at the point where the roaring South fork renders constant tribute to the parent stream, a mammoth masonry dam—probably the largest and highest in the world—rears its majestic walls.

This is called the "Cheeseman Dam," so named after its principal projector, and, with the land surrounding its beautiful attendant lake, containing some 30,000,000,000 gallons of filterable water, it will represent an approximate outlay of $2,500,000.

Constructing the Cheeseman Dam.

With the exception of the upstream face, which is of rough-pointed ashlar granite, with 1-inch vertical and horizontal joints, the entire dam is built of granite rubble blocks, shaped on the spot, and laid in Portland cement, which was hauled over tortuous mountain roads from the nearest railway point some 16 miles away.

From Denver this stupendously high dam is distant about 56 miles by rail, and 16 by stage, and on the guide book of the scientific tourist the world over, it should be numbered among the worth-while sights of the great West.

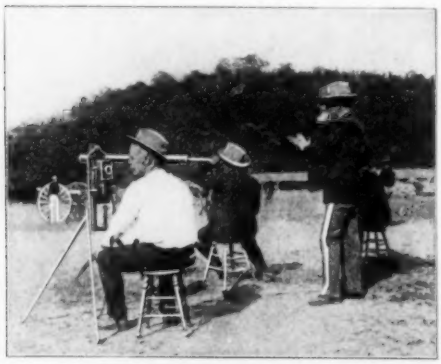
On the first of July, of the present year, the contract time expires; but already this colossal work is rapidly nearing completion.

At its lowest point the foundation is down to "bed rock" and will average a great many feet across the masonry line. The top of the parapet walls surmounting the lake will reach an elevation of some 221 feet, so that the total height from top to bottom will be 236 feet. At the base, the maximum thickness of the wall is 176, and at the top 18 feet. At an elevation of 90 feet, the extreme length is 130 feet, and on the top 700.

Of course, the construction of this huge dam is principally for irrigation purposes, and with Denver, Colorado's young leviathan metropolis straining to reach the 300,000 census mark, the early completion of the Cheeseman enterprise is hailed with joy. The "water ghost" is to be exorcised —banished for years to come. Irrigation and domestic supplies have been augmented beyond the point of want. "Onward, onward," is now the confident cry of the average Coloradoan.

MILITARY TELEPHONE REPORTS RESULTS OF SHOTS.

In artillery practice the telephone is now used to report the result of the shots from the target to those doing the firing. This means a great saving in time, for often the target is miles from the gun and in firing 20 shots when the information was sent



Telephone in Artillery Practice.

back by relays or "wig-wagged" by signal flags, says the American Telephone Journal, it occupied as much as two hours.

Where the telephone is used a specially prepared insulated wire for conducting the current is laid and the earth carries the return current. Where the line is for temporary service it is laid on the ground, but if to be permanent, it is attached to trees or laid in protected places. The line is grounded in some simple way, such as thrusting a hatchet into the earth and wrapping the exposed end of the conductor around it.

Such a line, three miles in length, can be installed in two hours, and the service it gives is quick and satisfactory.

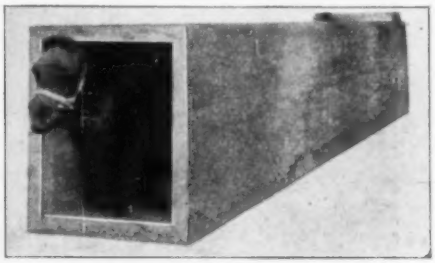
A PORTO RICAN AUTOMOBILE 'BUS LINE.

An automobile 'bus line between Camuy and Aguadilla, in Porto Rico, which places are the terminals of coast line railroads from Ponce and from San Juan, are soon to be established, thus connecting the two cities by a through line.

For its operating field the 'bus line will have a fine macadam road over the mountains, 26 miles in length. The mountain run will be of two hours' duration, and the entire distance (120 miles) between the two cities will be covered in 12 hours. The 'bus fare will be $3.00.

WORLD'S LARGEST ORGAN COMPLETED.

Can a pony walk through an organ pipe? Yes, if the organ is large enough, but there never was built but one organ of such gigantic proportions. It has just been completed and is to furnish music for the visitors to the St. Louis World's Fair. The accompanying illustration is from a photo-



graph of the big "C" of this gigantic musical instrument when a pony was standing inside with his head sticking out. The pipe is 32 feet long. The picture gives the pony a very queer appearance, as if he were nearly all head, but this is because of the photographer's blunder in not getting the proper perspective. The organ will make music so loud that it will shake the walls of buildings and the very ground will seem to quiver, the builders say.

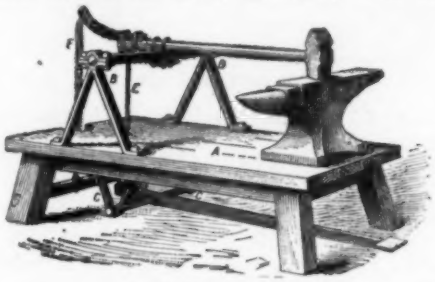
Automobile Stage Car in Porto Rico.

SHOP NOTES

A FOOT-POWER HAMMER.

A correspondent of the Blacksmith and Wheelright describes a foot-power hammer made by him 14 years ago. He says

"A is a wooden bench right height for anvil to set on under hammer; B B are



Foot Power Hammer.

pillow blocks for hammer to swing on; C is hanger for treadle to swing on; D is axle; E is connecting rod from treadle to handle; F is a spiral spring to raise hammer.

EXPLOSION OF A HOT WATER BOILER.

That kitchen hot water boilers are as liable to explode as any others under the right conditions, has been fully demonstrated by an explosion that occurred at a club house near Hartford, Conn., recently. No person was seriously injured, but damage to property to the extent of $2,500 was done, the building having an immense hole torn in one side and other rooms being wrecked.

The boiler was an upright cylindrical copper tank of 300 gallons capacity; had no fire under it, and the water was heated by a water front in a range. The only pressure it was supposed to be subjected to was 65 pounds per square inch from the city water mains and which amount was quite safe.

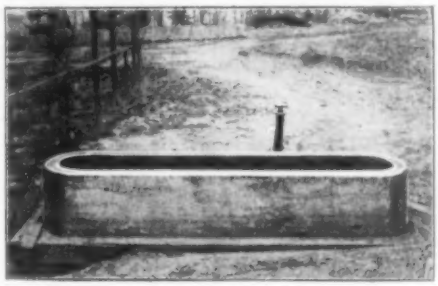
Investigation, however, showed that a check valve had been put in the supply pipe to prevent the water, when there was enough heat to generate steam in the boiler, backing up and injuring a water-meter on the supply pipe. Of course the water had no exit and the explosion followed.

There should never, for the reason shown, be a check valve in the pipe between a kitchen boiler and a water main, says The Locomotive. The boiler can in no way relieve itself of excess pressure when the water is overheated where there is a check valve. Such an accident could be prevented by providing the boiler with a safety valve. In England "dead weight" safety valves are commonly used on kitchen boilers, this kind of valves being very simple and reliable. A check valve and safety valve might both be used with safety providing the condition of the safety valve was looked after, but it were best to dispense with the check valve entirely.

A stop valve on the supply pipe is a positive necessity to a kitchen boiler, but should be placed where it could never be closed by mistake. If it were secured by a wire when open, the danger of closing accidentally would be eliminated and the wire could be easily broken if necessary to close the valve.

HOW TO CONSTRUCT A CEMENT WATER TROUGH.

Cement water troughs are good for long service as they will stand any amount of freezing without cracking. A correspondent of the Ohio Farmer tells hows to construct one:



Side View of Cement Trough.

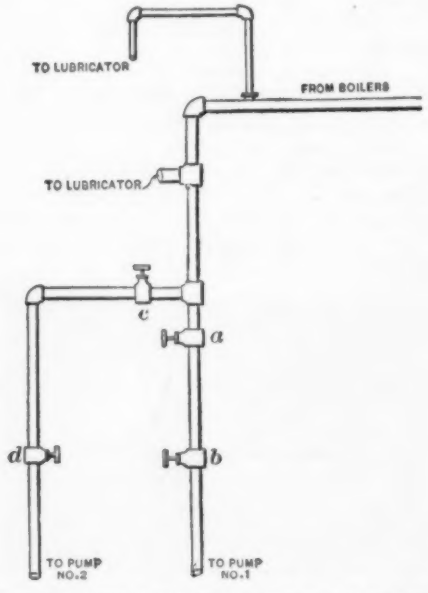
Excavate to the depth of 13 inches a place somewhat larger than the trough is to be; fill the cavity with broken stone, pounding it down until each piece is firmly embedded, pour thin cement over it until the crevices are full and smooth over the top. On top

of this construct a box exactly the shape the trough is to be, having the inside of the box perfectly smooth, with all cleats, braces, etc., on the outside. Make a similar box five or six inches smaller, having the smooth surface on the outside in this case. Place the small box inside of the larger one, brace and make solid and fill the space between the walls of the two with a cement made of one part cement to two of sand. Mix in dry state and but a bushel or two at a time. Wet just enough so that when it is shoveled into the mould and tamped down but a little water will rise to the top. After the cement has set for a time knock off the moulds.

It should harden very slowly. Keep full of water and sprinkle the outside of it. Such a trough costs about the same as a galvanized iron trough.

ONE LUBRICATOR FOR TWO PUMPS.

A correspondent of Power tells how he made one lubricator serve two boiler pumps, using one pump at a time and changing to the other in case the first gave out.



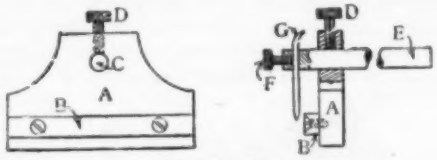
Connecting one Lubricator for Use with Two Pumps

Referring to the diagram the arrangement is as follows: If using pump No. 1, close valve C, then D, open A wide and regulate the pump by valve B. If No. 2 is used, close valve A, then B, open C, and regulate by D.

A MARKING GAUGE.

The marking gauge described here is useful for marking off sheet brass, copper, etc., where the material is of fair length, or the distance from the edge is out of range for use of jenneys, says a correspondent of the Model Engineer and Electrician.

It consists of a block of mild steel (or



A Marking Gauge

iron) (A), about ⅝ inch thickness. At about ¼ inch from the bottom edge is fastened a piece of ¼ square steel (B) by means of two screws countersunk flush, and at about ½ inch from the top is drilled a ¼-inch hole (C) to take a length of ¼-inch round steel (E), which should be a sliding fit. Another hole is drilled and tapped in the top of block to take the knurled screw (D) which is to hold tight the steel rod (E). At one end of E a hole is drilled to take a scriber (G), which may be made from a good-sized knitting-needle. Another hole is drilled and tapped to take the knurled screw (F), which is to hold tight the scriber. To use the block, the bar B must rest on the edge of the material to be marked, and the scriber and rod E adjusted.

HOW TO CUT GLASS JARS.

Fill the jar with lard-oil to the point where it is to be cut; heat an iron rod red-hot and plunge it into the oil. Because of the unequal expansion the jar will crack all the way around at the surface of the oil and the top may be lifted off.

TO TOUGHEN PLASTER CASTS.

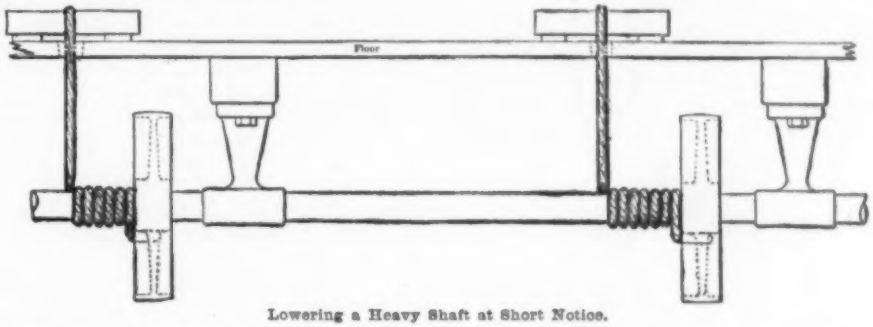
To toughen plaster casts immerse them till well saturated in a hot solution of glue. When treated in this manner a nail can be driven into them and not crack them.

The southern pine forests, from which is obtained the wood so much in demand for building and interior finish, cover an area 2,000 miles long, average 200 miles wide and embrace an area of more than 250,000,000 acres.

AN INGENIOUS HOIST.

The lowering, adjusting and raising of a pulley shaft 150 feet long having many pulleys from 2 to 5 feet in diameter, in a short time without blocks or tackle was the proposition to be met and a correspondent of the American Machinist tells how he dealt with it.

The shaft was, in places, 3 inches in diameter and at others, 4 inches. The



Lowering a Heavy Shaft at Short Notice.

3-inch places were wrapped until as large as the 4-inch. Six lengths of rope 1¼ inches in diameter were used, fastening one end of each piece to an arm of a pulley, the ropes being as nearly equidistant as the pulleys on the shaft would permit. Enough of each rope to reach from the shaft to the floor was then wrapped around the shaft and the other end passed straight up through a hole in the floor above and there secured to a piece of timber. The caps to the hanger boxes were then removed and the shaft was rotated by the rims of six pulleys, a man at each pulley, and in a direction calculated to lift the shaft out of the boxes, when two other men, by means of levers, swung it clear of them. Then the pulley reins were rotated so as to unwind the rope on the shaft and thus it was lowered. The method of raising was simply a reversal of that of lowering.

HOW TO FIREPROOF WOOD.

Wooden buildings or wooden parts of any structure can be made fireproof by a very simple method and at small cost.

Add enough water to a quantity of fresh quicklime to make it of the consistency of cream. Stir well and add two pounds of alum, 24 ounces of commercial potash and one pound of common salt. Mix thoroughly and apply while hot after the manner of applying paint. Pure white effect can be obtained by adding a couple of handfuls of plaster of Paris, or shades ranging from light gray to black may be had by adding lampblack, the amount varying with the shade desired.

Two coats of this mixture will keep wood fireproof for a long while and if the building should be subjected to flames for a time it will not blaze, but merely char. The mixture, with the addition of a few handfuls of white sand to every gallon of liquid, makes an excellent preservative for brick or stone.

TO PREVENT TARNISH ON SILVER.

Brush alcohol in which a little collodion has been dissolved over silver ware to keep it from tarnishing. The thin invisible coating the solution leaves can readily be removed by dipping the article in hot water.

REMOVING RUST.

To remove rust from metal, cover the metal with sweet oil, rubbing it in well, let stand 48 hours. With a piece of cotton wool apply oil freely, then rub well with powdered unslaked lime.

REMEDY FOR BURNS.

A saturated solution of Epsom salts is an excellent remedy for burns. Apply as soon as possible and keep wet constantly until pain ceases.

Among the disputed questions that never will be settled are: Whether a long screw driver is better than a short one of the same family; whether water wheels run faster at night than at day; the best way to harden steel; which side of the belt should run next the pulley; the proper speed of line shafts; the right way to lace belts.

HOW TO BUILD A CIDER MILL AND PRESS.

A correspondent of The Blacksmith and Wheelwright tells how to build a cider mill. We give the instructions here:

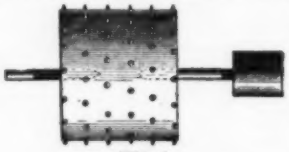


Fig. 1.

Fig. 1 shows the grinder—a black gum log—20 inches in diameter, 18 inches long. Into this drive spikes as shown, allowing them to stick up about ¼ inch. A rod is

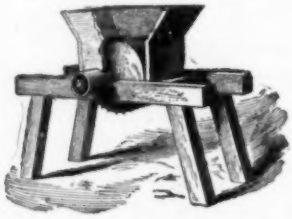


Fig. 2.

run through the log, and a pulley fitted on one end. Then build a frame as shown in Fig. 2, and your mill is ready for business.

Fig. 3 shows a cider press built of 10 by 12-inch timber, 8 feet long. Distance from post to post is 4 feet; mortises, 6 by 10 inches; pin-holes, 1 inch. Use a 3-inch iron screw, 5 feet long, operated by a 6-foot pinch bar.

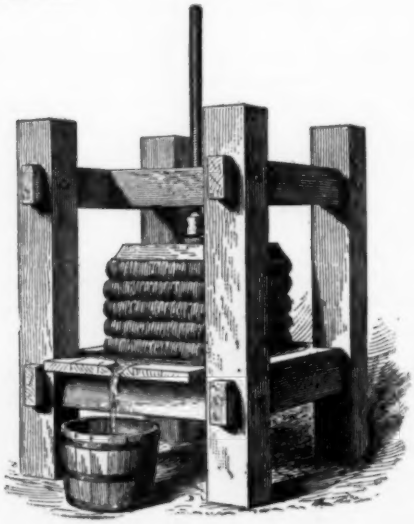


Fig. 3

COMBINATION ANVIL AND STRAIGHT-EDGE.

An anvil which will serve as a straight-edge as well as an anvil was contrived by a correspondent of American Machinist. It is placed so that its angle is in line with the operator's eye, for this purpose, and

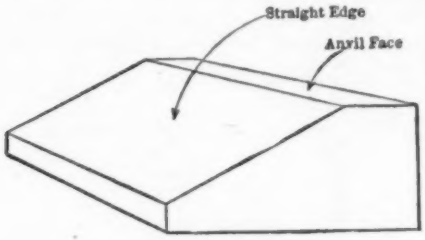


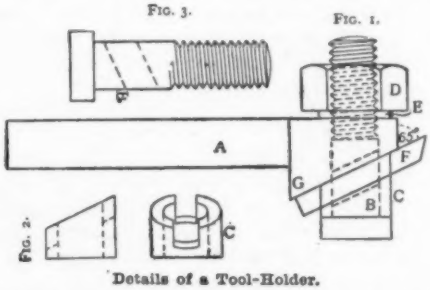
Diagram of Anvil.

should be set on a white paper to get a light background, so as to see more clearly between the face of the anvil and the forging while straightening the latter. For straightening badly bent and twisted small forgings it will be found most convenient.

A HANDY TOOL-HOLDER.

A handy tool-holder which is easy to make and inexpensive is here shown in detail.

The body of the toolholder (A) is cut from an old bicycle crank (axle end, of course), and is cut off at an angle of 65 degrees through boss at section, steel being



Details of a Tool-Holder.

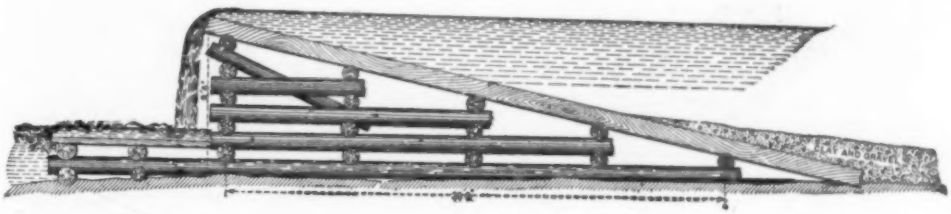
used for cutters (self-hardening). The body of holder at G (Fig. 1) beds against slide-rest, preventing spring of cutter. Perfect adjustment is provided by pushing cutter up or down, as may be required.

At the present rate of output England's coal supply will last but 371 years. The increasing use of gas and electricity for driving many mechanical mechanisms, however, it is believed will greatly economize the consumption of coal in the future.

HOW TO BUILD A SMALL DAM.

If you live near a small creek, or stream and enjoy boating, swimming, and fishing, but have no place suitable for these sports, why don't you build a wooden dam and make a place for yourself? A club of boys, two or three grown persons, or even a party of girls could pool funds and construct such a dam and create a source of pleasure for many summers and winters after. Boys or men could do their own work.

For such a purpose a crib dam is the construction best adapted to every phase of the case, as it can be built on any kind of a bed, can be of either plank or logs and in a locality where there is much timber land the expense will not be great.



Cross Section of Crib-Work Dam

Every locality has its individual conditions which must be considered, and among these are, the depth and width of the stream, its bed, the volume of water, and its velocity. In general the points to be remembered are: The dam must be securely fastened to the bed of the river so that the water cannot undermine it; must have abutments at the banks, or be built into the bank to such a distance that the water cannot work a channel for itself there; must be so solid that it cannot be overturned or shoved aside by the pressure of the water; where the river bed is soft, must have an apron so that the falling water cannot create a cavity into which the dam could be engulfed; must have a surface impervious to water.

If the stream has a rock bottom, it has a natural apron, but the foundation logs must be anchored to the rock. Drill holes in the rocks at places where the logs belong, split the anchor bolts up for five or six inches from the bottom and insert a wedge. Run the bolts through the logs into the holes drilled in the rock. When the bolts are driven in, the wedges expand them and they are thus secured in place. If the bed is of soil or gravel, dig trenches across the stream so deep that the logs when laid in them just show. Use logs or plank from 6 by 6 inches to 10 by 10 inches. Logs in the foundation course should be placed from 6 to 8 feet apart and extend deeply into the banks at either hand. If the stream is wide, splice two or more logs together. The second course of logs is placed at right angles to the first, or lengthwise the stream, and an apron is formed between the two foundation logs farthest down stream by placing planks between the logs of the second course and letting them project under the third course, which begins back about 8 feet. From here on the dam proper is built up of the crib-work as high as need be. Use tapering logs for the lengthwise course, letting their tapering ends point upstream. This gives the upstream side of the dam a slant. The pockets of the crib-work should have vertical sides and may be filled in with stones, brushwood, gravel and some clay. Gravel, however, is best, as the wooden dam is less liable to rot where it is used. Wherever logs cross, flatten them and bolt together by means of drift bolts ¾ by ¾ inches. Square bolts hold best.

For the cover of the dam use 4 by 12 planks, joined so as to be watertight, projecting a little above the crib-work at the top and extending into the bed of the stream at the bottom. Over this put a layer of gravel. In time a layer of silt will be deposited by the stream.

An outlet for the water should be left until the last thing and then closed as rapidly and closely as possible, being careful not to leave this spot weak.

In calculating the speed of pulleys, when the diameter and driven are given, in order to find the number of revolutions, multiply the diameter of the driver by the number of its revolutions, and divide the product by the diameter of the driven; the quotient will be the number of revolutions of the driven.

SOME TYPES OF OIL BURNERS.

We here show three methods of arranging oil burners and a method of attaching them. A correspondent of Power says that

Fig. 1

ONE TYPE OF OIL BURNER.

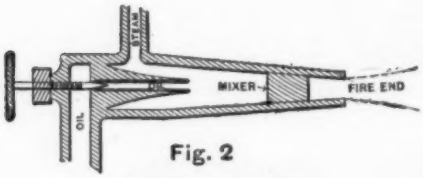


Fig. 2

ANOTHER BURNER.

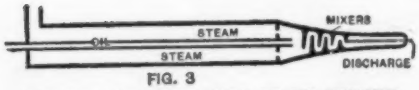


FIG. 3

ANOTHER ARRANGEMENT OF OIL BURNER.

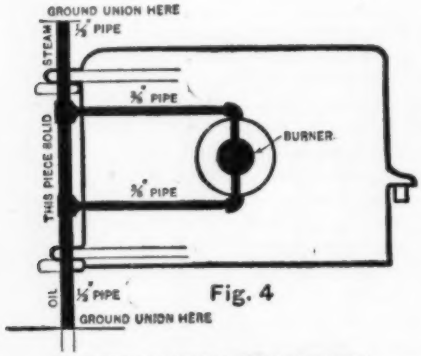


Fig. 4

METHOD OF ATTACHING BURNERS.

Fig. 2 attached as shown in Fig. 4 works beautifully, overcoming many difficulties met with in using other burners.

HOW TO MAKE A TRIP HAMMER.

Take two pieces of wood 8 by 8 inches by 4 feet; lay them eight inches apart and bolt another piece, 8 by 8 inches by 3 feet between them at the back end for an upright. Bolt a piece of 8 by 8 inches by 1 foot long between them at the front as a base for the anvil stand. Take a piece of iron 1½ by 1½ by 2½ feet long, weld a heavy plate on one end of this and bolt it fast to the base. Bore a hole in the upper end and square it into a 1-inch hole. Make an anvil die of tool steel with shank to fit this hole in the stand; drill a small hole through the stand and shank and drive in an iron pin as a key to hold the die.

Make two straps of new wagon tire; bolt to back upright on each side with a ¾-inch hole through the ends for a bolt to fasten hammer arm to. This latter bolt to a tee of the same material, turning the end of the cross tee to fit between the short pieces on the upright and fastening with a ¾-inch bolt. The arm may be made from the large part of a buggy tongue, and the hammer out of a sledge, swelling the eye about as large again. Cut off about one-half the large end and dress up, using the pene for the face of hammer after dressing this up also to suit the work. Brace it both ways solidly. A crank shaft of an old mowing machine may be used for a crank shaft and also the pitman rod for driving the hammer. Make a loop or strap out of wagon tire also to fit over the arm extending above and below about 10 inches, and put in coil springs there to take off the solid blow from the arms and hammer and also to throw the hammer up as a support to the pitman. Screw this pitman into the lower end of the loop under the arm and place a clamp on each side of the loop on the arm, to hold springs and loop in place. By moving the clamp and loop backward and forward the stroke can be regulated.

Next put a crank shaft in its old boxings about one-third way from back end of the base of hammer, and put a pulley wheel on outside end for belt to run in. The belt tightener, of course, can be fastened to the base or back upright to work with trip, which can be made of anything handy that will stand the pull on the belt tightener. It may be fastened to a separate post which is right by the hammer, to which fasten a countershaft, if the engine runs opposite to the way the hammer is to be turned; put in a short countershaft and then run a loose belt from it to the hammer. It gives a steadier belt by making it shorter, as six or eight feet of belting running loose from the line shaft to the hammer will flop, unless it is wide and heavy.

A correspondent of the American Blacksmith says the hammer will cost about $30 and that he has sharpened plows in 22 minutes and welded 1¼-inch axle stubs after taking first heat with hand hammer on such an one.

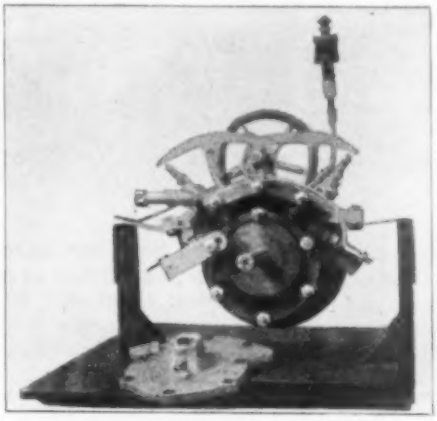
ROTARY GASOLINE ENGINE.

A 10-horsepower rotary gas engine, built on the model exhibited by Otto Konigslow at the March automobile exhibit in Cleveland, Ohio, is soon to be tried in an automobile. The Automobile describes the invention as follows:

"The stationary part of the engine is a cylindrical casting 8 inches in diameter and 4½ inches wide, outside dimensions. Immediately above and integral with this, as seen from left to right in the engraving, are the admission, compression and exhaust chambers. Valveless ports lead from the admission and exhaust chambers to the cylinder. A valve connects the admission and compression chambers, and another the compression and exhaust chambers. The main admission and exhaust valves may be seen at the top of the casting, on the left and right respectively. The operating devices for the valves, also shown at the top, are controlled by cams on a time shaft geared to the main shaft by a chain and sprockets, its time of revolution being one-third that of the main shaft.

"The rotary part consists of a cylindrical casting, mounted on a shaft and set eccentrically with respect to the stationary cylinder so as to be tangent to it at the top and to leave a considerable clearance space between the two at the bottom. The rotating cylinder carries a single blade, forced outward by means of a spring so that its outer edge is always in contact with the inner surface of the enclosing cylinder.

"The operation of the engine is as follows: As the blade passes the port of the admission chamber (the direction of rotation being left-handed), the intake valve opens and the charge is drawn in by suction for an entire revolution. At the beginning of the second revolution, just before the blade again passes the part, the admission valve closes and the charge (now being in front of the blade) is forced through the exhaust chamber, where compression takes place during the entire revolution. At the beginning of the third revolution, just after the blade has passed the port between the admission chamber and the main cylinder, the valve leading from the compression chamber to the admission chamber is opened, so that the compressed gas is allowed to pass into the cylinder. At this instant the gas is exploded by means of an ordinary sparking device located in the compression chamber and, impinging upon the sliding blade, rotates the shaft. During the next revolution, which corresponds with the one first described, the exploded charge is forced in front of the blade out through the exhaust valve to the air, a fresh charge being drawn in behind the blade at the same time for a new cycle of operations.



Rotary Gasoline Explosive Engine.

"The speed is controlled by varying the amount of charge and changing the time of ignition. At a speed of 1,600 revolutions per minute, there is so little vibration that holding-down bolts are unnecessary. This feature, together with its compactness, are the two qualities which recommend it most strongly for automobile service."

The engine is to be cooled by water circulation.

ELECTRIC TRAP TO KILL RATS.

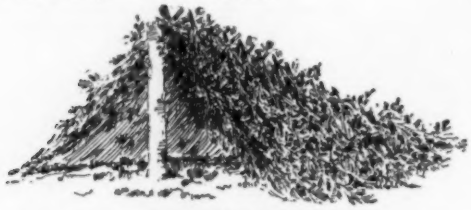
A clerk in Rochester, N. Y., used electricity to rid a warehouse of rats. In one corner he placed a flat piece of copper connected by a wire to the incandescent light circuit. On this copper plate he placed a tempting bit of cheese. Another copper plate, connected with the return wire of the circuit, was placed near, but not touching, the first plate. Rats, trying to secure the cheese, came in contact with both plates at the same time, thus completing the circuit, and were instantly killed.

PREVENTING RUST ON STEEL.

To preserve steel articles from rust, place a lump of freshly-burnt lime in the drawer or case in which they are kept. The lime will absorb a great deal of moisture.

Temporary Camps and How to Build Them

For a short camping excursion, or for use while the permanent camp is being built, nothing is more novel and delightful than the temporary camp built of the materials ever ready in the woods.



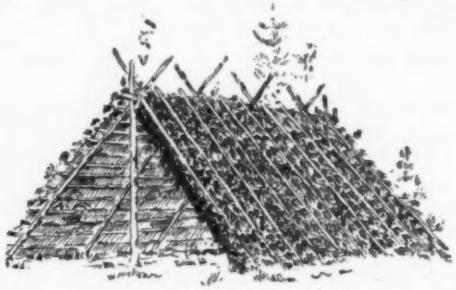
The Indian Camp

The simplest form of all perhaps is the Indian camp. To build this, cut an evergreen tree nearly through about five feet above the base of the trunk, so that when the top falls the butt will still be attached to the stump. Hollow out the under side of the treetop by removing boughs and branches. Use the trunk of the fallen part as a ridge pole and bank boughs and branches from it to the ground on either side. The shelter thus formed will be very comfortable, but there are other kinds better calculated to protect from heavy rainstorms. A wigwam sheds rain well because its sides are so steep. Set up three long poles in the form of a pyramid and tie their tops together. Fill the open spaces with poles set at the same slant about one foot apart at the ground and fastened at the top as before. Thatch the outside closely with branches and brush.

There are several ways to build a brush camp, but they all have many similar points. The ridge pole for such a camp (about 8 feet long) may be placed between two trees at a height of about 6 feet, or between two crotched poles set firmly in the ground for the purpose. Long branches may be used to form the sides, but the best method is to lay straight poles on slant from the ridgepole to the ground, about eight inches apart. Begin at the bottom and thatch the sides to the top to a depth of about one foot with hemlock or cedar boughs, laying them with the feather side down; by means of poles weight down the thatch. Such a shelter carefully made will withstand heavy rains.

The Wigwam

Another camp in high favor among campers for temporary shelter is the lean-to; this may be an open lean-to—that is,. without ends—or closed as desired and may be



The Brush Camp

thatched with either bark or brush. Select two crotched poles about 7 feet long and set in the ground. Lay another pole across these, with its ends resting in the crotches of the other poles. From this pole slant three other poles to the ground. Push the ends of them well into the earth and fasten securely by means of crotched sticks placed over them and driven into the ground. Across these last three poles lay cross sticks, on which pile brush and weight it down with other poles. Build up the sides in the same way. Where bark is used to

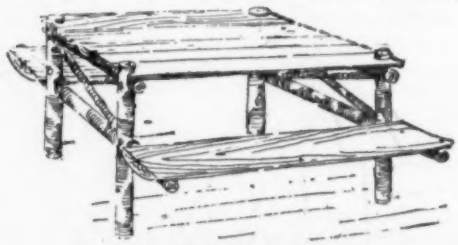
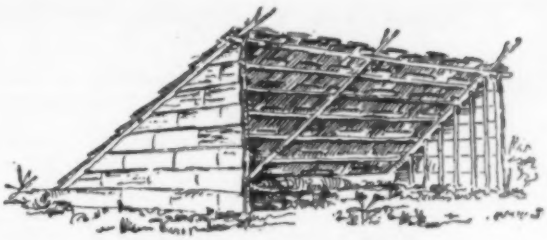


Table and Chairs Combined

thatch the lean-to the top side of the rafters should be flattened so the bark can be nailed

to them. Bark may also be used to thatch the wigwam, laying it in overlapping courses, beginning at the bottom, and securing it by means of cord.

To remove bark from trees, cut two circles six feet apart completely around the tree and join the cuts thus made by a vertical cut and pry away the bark by means of an axe. It is most readily removed in the early summer. Lay the bark on the ground to dry for a few days, weighting it down with stones, after which it is ready for use.



A Closed Lean-to, Thatched with Bark

Hemlock, spruce or cedar boughs, having all large boughs removed so that only fine branches are left, piled to a depth of two feet, and with the blankets or sleeping bag on these, make the best bed for the temporary shelter. Another form of bed can be made by sewing deep hems in each side of a piece of heavy duck canvas about 40

Tongs

inches wide and 6 feet long. Set four forked poles in the ground, run poles 7 feet long and 2 inches in diameter through the hems of the canvas and set up on the forked poles so it is about a foot above the ground.

In selecting a site for a camp always remember that above everything else fresh water within easy reach is essential. Shade for the hottest part of the day should be considered also. Other considerations vary

Broom of Hemlock Twigs

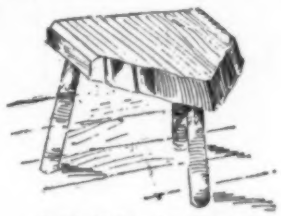
with the party, the duration of the outing, the country surrounding, etc.

To make a crane set two green sticks 2 inches thick and 3 feet long into the ground a foot from either end of the fire. Split the top ends with an axe and provide another stick as a support. A pair of tongs may be made from a piece of tough green wood, which should be 1½ inches in diameter, 3 feet long and of some wood, such as elm, or hickory, which will bend easily. Cut it half way, a distance of one foot in the center, heat the center over a bed of coals until it will bend together without breaking, whittle into shape and fasten the two arms in position by means of a cross-piece. Shape the ends so they will catch hold of anything that has dropped into the fire. A round stick several feet long will serve as a poker.

To make a broom bind hemlock twigs around one end of a stick, using wire or stout cord to hold them in place. Stools are easily made by sawing a 3-inch block from a log a foot thick. Bore three holes in one side of the block, into which drive pegs. A back may be added if desired.

For a rude table set four posts in the ground, nail cross-pieces on top, and cover with slabs cut from soft wood logs. At the right height for seats nail pieces on the legs to extend out on each side and receive slabs which will serve as seats.

Many other articles of use about the temporary camp can be made from such materials as the timber affords. Such things as



Stool Made of a Block

nails, cord, an axe, etc., are indispensable to the camping outfit.

[Next month full details with 17 illustrations "How to Build a Permanent Cabin."]

UNITED STATES OSTRICH FARM.

Ostriches imported from South Africa to Arizona 11 years ago are thriving. At first the birds did not do well, but the last five years have shown a marked difference in them. They are some inches taller than their African ancestors, standing 8 feet high, and weigh 200 pounds. There are now 1,000 birds in the Salt River valley, each yielding about a pound of feathers every eight months.

Modern Telegraphy Necessitates Brain

The Phillips Code for Sending Press Dispatches is as Difficult to Learn as a Foreign Language

Telegraphy is regarded by the general public as a purely mechanical occupation requiring little skill, judgment or intellectuality, and the telegraph operator is considered a tool-like medium whose duty is merely to transfer the thoughts of superior minds from one locality to another. Nothing could be more erroneous, and those who hold such opinions have little knowledge of the real duties required of modern telegraphers. Telegraphers must have quick wits and splendid memories in order to succeed; their work is one of the finest of mental trainings and has often resulted in elevating telegraph operators to high stations in life.

Railroad telegraphy and telegraphy by the Phillips code, as now employed by the Associated Press, require a high degree of intelligence. The modern telegrapher must be an expert typewriter as well as telegrapher, receiving news matter by ear and typewriting it at the same time. In the Phillips code there are about 2,000 combinations and signs which the operator must have literally at his fingers' tips. This code consists of words and signs which, in themselves, constitute a language nearly as difficult as the Chinese, and which are absolutely unintelligible to any but the expert operator.

Here is a copy of a press message recently sent out by wire:

"T potus, ixs wi km to Kevy his itn to oa sign t agm q Pip qsn."

Written out in full, as the receiver translates it on the typewriter, the message reads:

"The President of the United States, it is said, will communicate to King Edward VII his intention to at once sign the agreement on the Philippine question."

In the Phillips code nearly every letter in the alphabet is employed singly to denote some combination of words, and words are used to represent phrases. Thus "hog" means "in consequence of," "kaw" means "adjourned sine die," and "ck" means "committed suicide." Here are the first sentences of a press dispatch as it was received over the wire. It was sent from Chicago. Leaving out the date line, it runs:

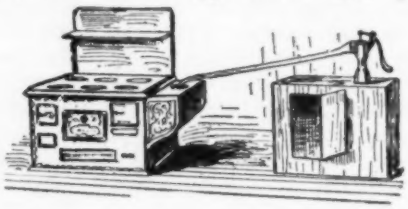
"A dsx fi at 2 oc tsm nry rekd t sto oqd bi Cx Smith Bros on Sta str. T origin f fi is unkn. Iw fs dgd bi ofc Obien dily bak f ofs q er floor. T flas wr shootg k entrance q alley es t awng hr ws in flas. T fi dpm tru an er, was cld to thr sto on Madison str es wn t engs arvd t flas wr mkg gd hedwa d rear prt f bldg es smoke was isng fm all prts f bldg."

The operator takes this message by ear and writes it off on the typewriter as follows:

"A disastrous fire at 2 o'clock this morning nearly wrecked the store occupied by Smith Bros., on State street. The origin of the fire is unknown. It was first discovered by Officer O'Brien directly back of the office on the lower floor. The flames were shooting out of the entrance on the alley and the awning there was in flames. The fire department, through an error, was called to their store on Madison street, and when the engines arrived the flames were making good headway in the rear part of the building, and smoke was issuing from all parts of the building."

CONVENIENCE FOR HOUSEWIVES.

A small conductor pipe running from the pump or a faucet at the sink to the range reservoir is a simple contrivance which any housewife would appreciate. The pipe



Filling the Range Reservoir

should be funnel-shaped at the upper end and just large enough to slip over its connection which should be some inches higher than the reservoir. The pipe being small, can be easily stowed away when not in use.

In the Lofoten Islands cod-liver oil is never adulterated in the winter time, because cod is the only fish caught there at that time. Only within the last two years the practice of adulterating cod-liver oil with oils from the livers of cusk, haddock, coal fish and ling has been known. In the summer time these oils are refined and used extensively.

MECHANICS FOR YOUNG AMERICA

HOW TO MAKE A PROPELLING VEHICLE.

Any boy, with a little knack and a few odd tools, can rig up various contrivances which will be a source of pleasure to himself and oftentimes can be sold, to less ingenious boys, for a snug little sum. Any tool a boy can obtain is apt to be of use to him, chisel, bit, jack-knife or hammer.

Figure 1 shows what two boys did with old cycle wheels. They went to some junk shops where the concerns had purchased cast-away bicycles and noticed that there were numerous wheels in very good order that could be selected from among the sets of wheels with broken or bent rims, spokes, burst tires, etc. In fact, the lads had no trouble in getting several sets of bicycle wheels in fit condition for use at 20 cents for each wheel. These wheels were taken to the back-yard shop of the boys where the young fellows had rigged up a shed-like affair and put in a bench. The previous Christmas one of the boys had had a box of tools given him, and these tools included a little hand vise and the required tools for general boy's handiwork.

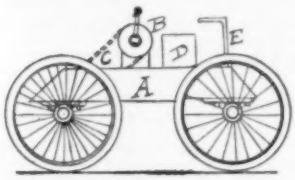


Fig 1

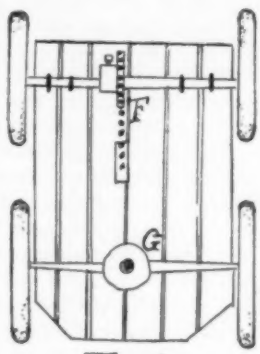


Fig 2

Four of the cycle wheels they used in making the hand-propelled vehicle shown at Fig. 1.

A wooden body, A, made of smooth boards rests upon shafts. Fixed on this body is an upright carrying the cog B. The upright is a piece of wood about 10 inches high and 4 wide, fitted with one of the bearings from the cycle. The regular cycle chain cog is used at B as well as upon the shaft. The regular chain of the cycle is likewise employed, so, when buying the wheels, it is well to select one or more chains with corresponding cogs from the junk heap. The detail of the adjustment of the parts is shown in next views. The letter D signifies the seat which is a box. The steering gear is a bent iron rod, also found in the waste pile of the junk shop, and is bent to right form by heating and bending over on a rock or any solid matter. The steering rod is marked E. It fits into a socket in the shaft of the forward wheels.

Fig. 2 shows the construction of the cart below. The cog is keyed or set-screwed to

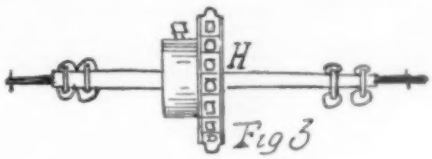


Fig 3

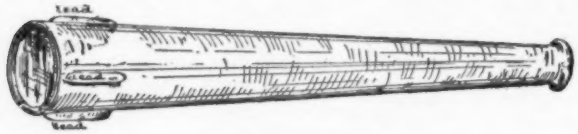
Fig 4

the driving shaft of the wheels with either key or set-screw used in original fastening, as the case may be. The chain is marked F, and there is a slot cut in the floor of the cart to let the chain pass up and through to the cog on the propeliing shaft crank. The disk which receives the steering rod is at G. The forward shaft bears only at the center upon a disk of metal, consisting of any circular piece found among the pieces of iron or brass at the junk store. One can get nearly all the mechanical parts in junk establishments that purchase parts of out-of-date or cast-away bicycles. The detail of the driving shaft is shown at Fig. 3. The cog work is at H and this is just as it is taken from the original bicycle shaft. The bearings consist of wires looped around the shaft and inserted into holes bored in metal plates as shown. These plates are screwed to the bottom of the cart. The shaft itself is found in rods or even cast-away metal axles which are commonly found in most any carriage works, cycle shops or junk dealer's. Fig. 4 shows the disk that receives the steering gear. The disk is bored around edges for the securing screws, while the

center is open for the steering rod. When put together, three boys usually ride. One steers and the other two turn the crank. Freight can be carried and some boys do quite an express business in their town with one of the carts like this that they made.

HOW TO MAKE A WATER TELESCOPE.

Before you decide on a place to cast your hook it is best to look into the water to see whether any fish are there. Yes, certainly, you can look into the water and see the fish that are there swimming about, if you have the proper equipment. What you need is a water telescope. This is a device made of wood or metal with one end

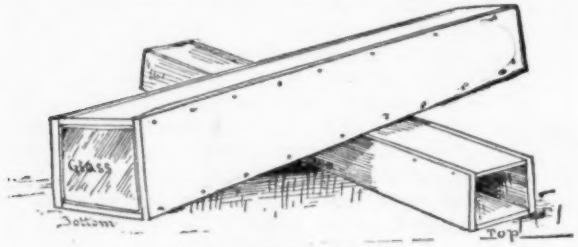


Tin Water Telescope

of glass. When the glass end is submerged, by looking in at the open end, objects in the water are made plainly visible to a considerable depth. In Norway, the fishermen use the water telescope regularly in searching for herring shoals or cod.

All that is necessary to make a wooden water telescope is a long wooden box, a piece of glass for one end and some paint and putty for making the seams watertight. Fix the glass in one end of the box, and leave the other open to look through.

A tin water telescope is more convenient than the wooden one, but more difficult to



Wooden Water Telescope

make. The principal essential for this is a circular piece of glass for the large end. A funnel shaped tin horn will do for the rest. Solder in the glass at the large end and the telescope is made. Sinkers consisting of strips of lead should be soldered on near the bottom to counteract the buoyancy of the air contained in the watertight funnel and helps to submerge the big end. The inside of the funnel should be painted black to prevent the light from being reflected on the bright surface of the tin. If difficulty is found in obtaining a circular piece of glass, the bottom may be made square and square glass used. To picnic parties the water telescope is of great amusement, revealing numerous odd sights in the water which many have never seen before.

HOW TO MAKE PAPER BALLOONS.

Any boy who can make kites can make enough paper balloons for a Fourth of July celebration and can make and sell enough of them to pay for all the necessary materials, which are very few.

Paper balloons may be of any size desired and have as many gores as one wishes in whatever colors one prefers. A very good size is 3 feet in height with 32 gores, each gore being 3 inches wide at the bottom, 8 inches wide at its widest point and 1 inch wide at the top. To make the balloon pear-shaped, the three widths mentioned when added together (3 + 8 + 1 = 12) should be one-third of the height of the balloon.

Procure close-textured tissue paper in any contrasting colors you like; red and white are good. Cut out a pasteboard pattern exactly the shape and size the gores are to be and cut the gores out by it.

Varnish each gore with boiled oil and hang it up on a line to dry, being careful not to let it come in contact with any other gore. When they are perfectly dry put them together by means of gum water, or clear thin paste. To do this gum about one-half inch of a gore and lay one edge of another gore midway across the gummed space and dab down very lightly by means of a clean cloth. In this manner unite all the gores in pairs until there are but 16 parts. Continue to unite them until you have two halves. Join these very carefully, closing the balloon at the top completely. Each time you paste a gore hang the part up until perfectly dry before using it further.

In the bottom of the balloon work a circle of wire 6 inches in diameter and fasten a wire with a piece of sponge strung on it across the circle of wire. A light car or

other light weight may be attached to the wire and will help to steady the balloon as it ascends.

To start the balloon on its ascent immerse the sponge in alcohol, then hold the balloon by the top over a piece of smouldering brown paper until it is sufficiently inflated; ignite the sponge and let the balloon ascend.

NEW YORK HAS TWO NEW $180,000 FIRE BOATS.

New York's fire boat equipment has recently been increased by two $180,000 boats, the "Abraham S. Hewitt" and the "George B. McClellan." Formerly there were five boats in service; now there are seven, but two are laid up for repairs. The "Hewitt" is in service at Brooklyn.

U. S. GOVERNMENT TO CONTROL WIRELESS TELEGRAPH STATIONS.

The United States Government has laid its restraining hand on the erection and operation of wireless telegraph stations for trans-ocean messages, at stations within our national domain. Marconi mastered the mysteries of space telegraphy, but will have to secure consent of the Federal authorities before proceeding farther. The necessity of government control of so powerful a factor in time of war is self-evident. Ocean cables can only be landed on any shore by the express consent of that country, and the same rule will now be applied to the new wireless system. Unless Marconi can secure the coveted consent he will be required to take down and remove all his stations in this country.

The "George B. McClellan," New York's New Fire Boat

The "McClellan" has a length over all of 116 feet, perpendicular 109 feet, breadth 25 feet, depth 13 feet 8 inches. It is provided with two cylinder compound engines, horse-power cylinders 17 inches in diameter, low pressure cylinders 34 inches, stroke 24 inches, two single and Scotch boilers 10-9 inches diameter; two vertical duplex fly-wheel pumps, two 7-inch steam cylinders, two 10-inch pumps, 11-inch stroke; one pump of same design with two 9-inch steam cylinders and two 5½-inch pumps, 8-inch stroke. There are three monitor nozzles on the boat. Its capacity is 7,000 gallons a minute.

Earn a trip to the World's Fair. Write Popular Mechanics for particulars.

FERRIS WHEEL MOVES TO ST. LOUIS.

The great Ferris wheel, which was the mechanical feature of the Midway at the Chicago World's Fair, has been taken down and shipped to St. Louis. The material filled 120 cars, the large shaft alone weighing 76 tons. The expense of simply taking down the wheel was $40,000.

A boy in Waterville, Ohio, who expects to graduate from high school this year, is finishing his course over the telephone. As a result of an injury one of his legs is in a plaster cast so that he cannot attend his classes. Every day he is carried to the telephone and recites his lessons in that manner.

DAILY PAPERS PRINTED IN MID-OCEAN.

Wireless Telegraph Specials to be Issued Each Day With the News of the World

The worn-out business and professional man accustomed to seek retreat from care and worry in an ocean voyage will now have to find some other means of escape. Within a few weeks the shrill cry of the newsboy as he makes the rounds of cabins and decks, will announce another day as he calls out "mornin' paper." One more feature of city life will be added to the long list already provided by the ocean greyhounds, and the new occupation of "ship's editor" will be created.

Wireless telegraphy is to be utilized for publishing a daily newspaper on board Atlantic steamers. The paper will contain the same news that Chicago and New York citizens will read on the downtown trip of mornings, having full benefit of the Associated Press telegraphic reports and being of standard size. Moreover, German, English, American and ships of other countries will publish exactly the same news in the various languages. The editorial rooms will be located ashore and new matter, changes in advertisements, etc., be transmitted by wireless telegraphy.

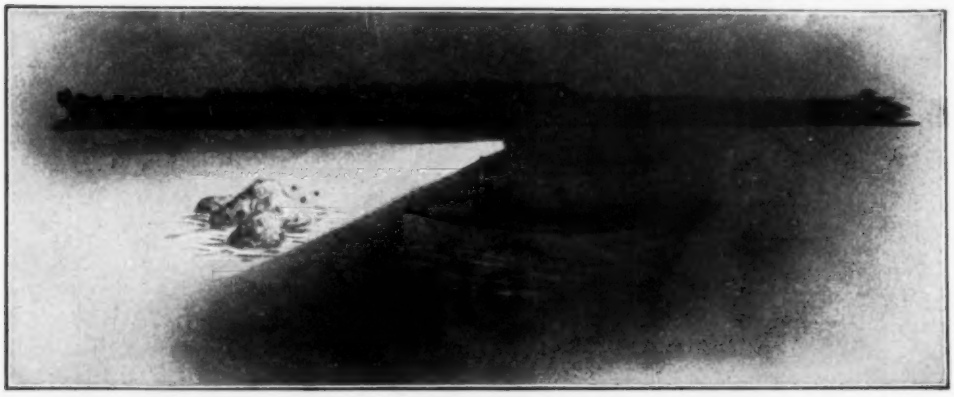
It is said that the project involves figures which will make it profitable for those backing it; that there are from 20,000 to 30,000 people on the seas at times and that space in such a paper will be worth while to advertisers.

The German budget bill for 1904 calls for $64,600,000 for naval purposes.

SEARCHLIGHT FOR LAUNCHES.

The boating season is at hand and to a larger extent than ever before are people buying and using motor boats of various kinds. For running at night a strong headlight is a prime necessity; not only to avoid running into obstructions, but to prevent being run into by other craft.

Experiments recently made by engineers on German railroads as to which light had the most penetrating powers during a fog show that acetylene proved itself to be the best. A test was made in a dense fog, three locomotives being stationed in the railroad yards, the headlights of which were supplied, one with an electric arc, one with the usual oil lamp and the third with acetylene of three-fourth foot flame. At a distance of 75 feet the electric arc light was entirely obscured; at 100 feet the oil light was lost from sight, while at this distance the acetylene light showed hardly perceptible diminution, and was visible at 200, 300, 400 and finally 500 feet from the locomotive, at which distance it was still in sight, although faint. These tests and measurements were made by careful men and can be considered trustworthy.



Acetylene Searchlight for Launches.

Including Alaska, Hawaii, Porto Rico and the Philippine Islands, the gross area of the United States (land and water surface) is 3,622,933 square miles.

All colors, save drabs and aniline browns, can be matched by the arc light, provided the arc is clear and open and the carbon pencils free from sodium and calcium.

LIMERICKS.

A musician there was—Paderewski—
Who never would drink nor would chewski;
As a matinee blade,
He made Hackett afraid,
And quite broke the heart of John Drewski.

There was a fair maiden of Siam,
Who said to her lover, "O Priam,
You may kiss me, of course,
But you've got to use force—
And God knows you are stronger than I am!"

There was a young lady of Skye,
With a shape like a capital "I!"
She said, "It's too bad!
But then I can pad"—
Which shows you that figures can lie.

Young Henry went out for to shoot,
With a gun and a high rubber boot;
He shot an old goat,
A guide and a shoat—
But he's best when he's shooting the chute.

There was an old lady of Threedle,
Who sat down in church on a needle,
Tho' deeply embedded,
'Twas, luckily, threaded,
And quickly pulled out by the beadle.

LONGEST CABLEWAY IN THE WORLD.

A cableway starting from a point 3,430 feet above sea-level and extending 22 miles to a point 14,933 feet above sea-level (1,300 feet higher than the summit of the Jungfrau) is to be built over the Andes. The engine station will be located at the highest altitude of any in the world, and below the cableway will be a rugged chain of rocks, yawning chasms 300 feet wide and 600 feet deep and in some places it will be necessary to have iron towers 130 feet high for supports. The cable rope will be 87 miles long.

For the construction of the cableway all the materials required will have to be carried to the spot by pack mules. By despatching a bucket load of 1,100 pounds of ore every 45 seconds the line will be able to handle 44 tons an hour.

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Are you getting a living by WORK alone? If so, there is something BETTER for YOU. This little ad. may be the KEY to open the golden door to wealth and enjoyment. Many readers of Popular Mechanics have joined us. Why not YOU? It will cost you but 1 cent to investigate. We will send you our 20-page illustrated book
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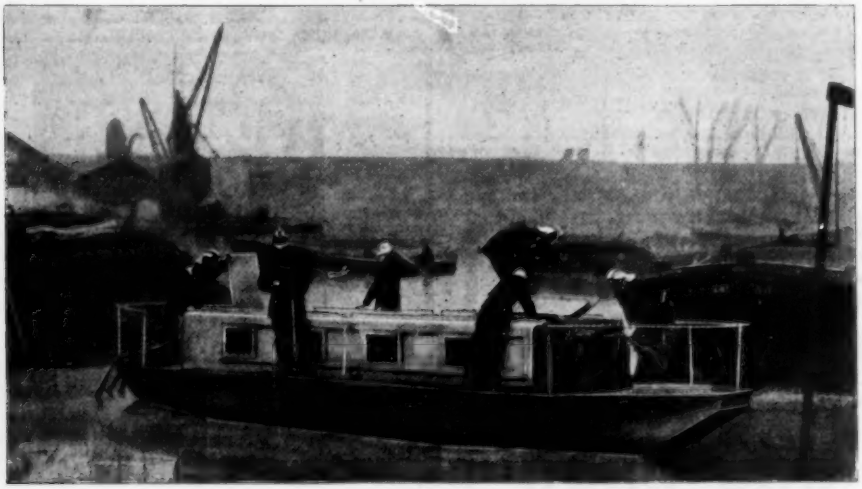
Fireboat Propelled by Spouting Water

A new fire float for the protection of a large biscuit works located on the Reading Canal, England, is propelled by means of jets either ahead or astern and is steered by shutting them off on either side, by means of levers on deck. Two pumps, taking suction from both or either side of the boat, and driven by two 30-horsepower, 4-cylinder petrol motors, deliver into a main pipe running fore and aft; from this main pipe there are six hose connections, so that six streams can be thrown at once. The little float has a steel hull 32 feet long, with a beam 9 feet 6 inches; draws 2 feet 6 inches when fully loaded; has 4 feet 6 inches head room, being built to pass under bridges. Her reels carry 1,000 feet of hose; the capacity of her pumps is 600 gallons per minute and she can travel at the rate of five to six miles an hour.



Water-Propelling Fireboat

Your boy, doubtless, has already become interested in the department of Popular Mechanics entitled "Mechanics for Young America." It is good for him if he has. Not so much because of the money value of the things he learns to make, but because they teach him what his efforts can achieve. Such knowledge in after years enables men to dig canals dividing continents, to build great railroads, to tunnel mountains and to construct great steel skyscrapers in our modern cities. It is a kind of knowledge worth cultivating in the young American brain; for just as mechanical equipment decides the fortunes of war, so does mechanical knowledge in this age of mechanics measure the power of nations, the greatness of cities and the competency of men.

THE RELIABLE

ELECTRIC VEST POCKET LIGHT

If you wish to find a house number at night; if you wish to find an article you have dropped; if you wish to avoid dangerous places in dark streets, just "press the button" and you have an instant, brilliant light. Will give eight thousand flashes, or burn three months with right usage. Inexpensive to buy and to operate!! Invaluable to physicians, or miners and gasfitters who go in dark places where any other form of light is dangerous. Batteries and bulbs easily detached and renewed when required.

$1.50—Complete—$1.50

Write for prices in quantities and complete catalog. Agents wanted

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We promise you nothing in return, but if you should be put in the way of making $1,000.00 through this original investment, you would be satisfied and would doubtless not hesitate to tell your friends.

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If you have sent money to people who promised great big returns but gave you nothing, just take a shot where nothing is promised then compare results. We will report at once and will venture the assertion that it will be a great and pleasant surprise to you, and it will reveal a way as plain as A. B. C. for you to keep right on making money. We are on the inside and it is to our interest to have you with us.

We want to reach 100,000 people in sixty days and we have the only practical way in which this can be accomplished and at the same time have all of same interested with us.

We want the right kind of people associated with us, and furthermore, want their entire confidence, and have adopted our own peculiar system of securing both at a small expense.

Only one person in each city (unless over 10,000 inhabitants) allowed this Original Proposition. Consequently, we accept the first reply and reserve the right to return all others.

You have no time to waste, neither have we, so don't waste time writing, as we treat one and all alike, and if you have the "nerve" send us your $10.00, otherwise pass us by. A Business Proposition for business people. If you wish to better your condition, remit at once while the opportunity is yours. Make checks, drafts or money orders payable to M. H. Burt, Mgr., and address,

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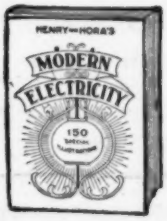

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YACHTING TERMS AND THEIR MEANING.

With the yachting season nearly upon us it is time to learn the meaning of yachting terms in common use. Here they are:

ABEAM—At right angles to the ship's side. A wind is abeam when it blows at right angles to the ship's course.

AWASH—Level with the surface of the water.

BACK STAYS—The ropes or stays that help to support the mast, and are attached to the deck aft of the mast.

BAG—Sails are said to bag when they do not set flatly.

BARE POLES—No sails set.

BEAM—The breadth of a vessel at its widest part.

BEAM ENDS—When a vessel lies over so far that her deck is perpendicular to the water.

BEAT—Beating to windward is making way (sailing) against the wind, going in a zig-zag course.

BOW—The forward end of a ship.

COMING ABOUT—"About ship," or tacking, is to put a vessel on the opposite tack from the one it had been sailing.

DRAUGHT—Depth of a boat in water.

FORE AND AFT RIG—Sails and spars lengthwise of vessel; sloops, schooners, etc.

IN IRONS—A ship is said to be in irons when it is head or bow to the wind and will not turn to right or left.

IN THE DOLDRUMS—When a ship is laboring between a calm and a light puff of air.

JIBING—When the course is changed while running before the wind in a fore and aft rigged vessel so as to bring the sails from one side over to the other.

KNOT—A nautical mile—6,087 feet. Applied to speed only. The statute mile is 5,280 feet.

LEECH—The aft edge of a sail.

LEE SIDE—The ship's side away from the wind.

LUFF—To come into the wind so that the sails do not draw. The forward edge of a sail.

MISSING STAYS—Failing in an attempt to tack come about.

OFFING—Away from the land toward the sea.

PEAK—The upper after corner of the mainsail.

PORT—The left side of a ship.

QUARTER—Either side of a ship between the stern and amidships.

REACHING—When the ship is sailing with the wind on the quarter.

REEF—To shorten sail.

RIGGING—Everything that supports the masts or other spars, or that is employed in setting or trimming sails.

RUNNING—When the wind is directly aft, behind, astern.

SAILING OFF THE WIND—When the wind is aft of amidships, the ship is then sailing free.

SAILING ON THE WIND—When the wind is forward of amidships, the ship is then close hauled.

SHAKE OUT A REEF—To loosen that part of the sail that has been previously reefed or tied in.

SQUARE RIG—Sails and spars across the vessel, ships, barks, brigs, etc.

STARBOARD—The right side of a ship.

STERN—The aft end of a ship.

WEATHER SIDE—The ship's side on which the wind is blowing.

A Good Figure

Is spoiled by stooping shoulders. The best aid to securing an erect figure is

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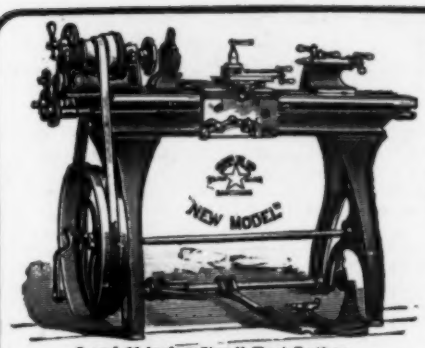

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WHY WAVES OF LIGHT DO NOT PASS THROUGH SOLIDS.

Why do X Rays and the Hertz waves pass through solids, while waves of light do not? Light waves will not pass through because the waves are about the same length as the spaces between the atoms in a solid. X Rays will go through because they are so much smaller than these spaces. Hertz waves will go through because they are so much larger than these spaces.

The space between the atoms is, roughly stating, about the hundred-millionth part of an inch; a light wave is about the same distance across, and is many thousand times greater than the distance across an X-Ray wave. Hertz waves may have any size, from a few inches to many miles across.

Imagine these waves to be the ordinary waves of the sea; imagine the solid to be a long row of high stakes at regular intervals apart in this sea, broadside to the waves.

Suppose that the stakes (which represent atoms) are about three feet apart, and there are forty or fifty rows of them for the waves to get through.

(a) Waves of from two to ten feet across will be broken up and almost entirely stopped, and inside the stakes there will be calm. This corresponds to waves of light breaking on a piece of wood—behind the wood it is dark.

(b) Imagine the great breakers of the ocean 80 to 100 feet across to break on the stakes; these waves will pass through almost as if the stakes were not there. Similarly, a wall a foot or two through will have very little effect on the Hertz wave two or three miles across, in fact, less than the thinnest tissue paper will have on the light of the sun.

(c) Imagine the spaces between the stakes to be some thousands of feet instead of three feet, our waves of two to ten feet will pass through without any trouble. This corresponds to X Rays passing through the spaces between the atoms. If the barrier of stakes be made more dense, the waves will pass less easily through it; in the same way X Rays pass with more difficulty through heavy dense metals than through light wood.

So solid matter is transparent to the Hertz waves because they are so big; to Röntgen Rays because they are so small.

Electric Motors, 65c., Post-paid

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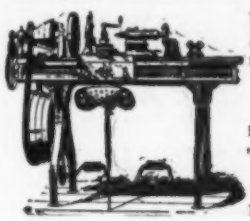

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INVESTOR'S REVIEW, 1461 Gaff Bldg., CHICAGO, ILL.

NEW TRIUMPH FOR THE PHONOGRAPH.

A large audience at Fort Harrison listened to a band concert given over the telephone line by a phonograph and though they were getting the real article. The concert had been arranged for to be given by the Brewery Band at Butte, Mont., but when the time came the telephone line would not work. The manager of the telephone company settled the matter by moving his phonograph up to the telephone and the Fort Harrison audience enjoyed the evening without a suspicion.

A Wonderful New Invention

...is the...

"O-HI-O" COMBINATION BAKER and STEAM COOKER.

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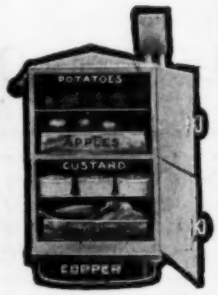

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MAY MAKE PAPER FROM BARK.

Experimenting With Japanese Plant, Which Produces Finest Fiber.

Experiments are being carried on by the Department of Agriculture with a new paper plant from Japan, called mitsumata. The experiments are the result of one of the trips of Barbour Lathrop, of Chicago, and D. G. Fairchild, the foreign agent for the Department, to Japan and other foreign countries in search of plants for the government. Mitsumata is believed well adapted to the warmer parts of the United States and is one of the most valuable plants known for the product of bark paper, so much used by the Japanese. It offers an entirely new crop to the south if it can be successfully raised there. Millions of Japanese live upon the revenue created by the manufacture of paper and most of the product is obtained from bark cultivated on an area about one-third the size of the state of Illinois.

Mitsumata is a pretty plant, with branching stems, broad, bright green leaves, and bears a yellow flower. It stands about five feet high and is shaped something like a vase. The plant flourishes upon land too poor for rice growing, is especially adapted to clay soil and from 600 to 2,000 pounds of raw bark is produced upon a single acre. This pulp is worth in Japan from 15 to 16 cents a pound, or just four times as much as the wood pulp imported from America sells for in Yokohama.

Hundreds of tons of filthy Egyptian rags are imported into this country every year to supply the American paper mills. At Mannheim, on the Rhine, the Americans have rag picking houses where rags are collected from all over Europe, the disease infected Levant not excepted, and all is so revolting that the women and children who work in these houses have to keep wet sponges tied over the mouth and nose through which to breathe. When these things are considered it seems that mitsumata might be a grand prize for American manufacturers. The best paper in the world is made by the Japanese from fibers and barks and if mitsumata can be grown here and save the importation of hundreds of tons of disease spreading rags into New York yearly, it will prove a great factor in American resources.

NEW FRENCH IDEAS IN AUTOMOBILES.

New automobile racers in Paris are being fitted with direct axle transmission instead of chains.

A Paris manufacturer has just completed a machine for the Khedive of Egypt which is said to be the handsomest automobile ever built. It is a superb couple-saloon, finished in dark blue with gold lines. The entrance is on two sides. The interior is upholstered in light green cloth and is lighted with electric lamps. A speaking tube communicates with the driver. A complete silver toilet is fixed under the chauffeur's seat. The vehicle is a marvel of luxury.

UNCLE SAM BUILDING THIRTEEN BATTLESHIPS.

America has more battleships building than any other nation in the world. There are thirteen, including the Idaho and Mississippi, in course of construction. Great Britain has twelve battleships being built and is constructing 17 armored cruisers against eleven for the United States. France has nine armored cruisers building; Russia has one completed submarine of 175 tons, and 14 in course of construction.

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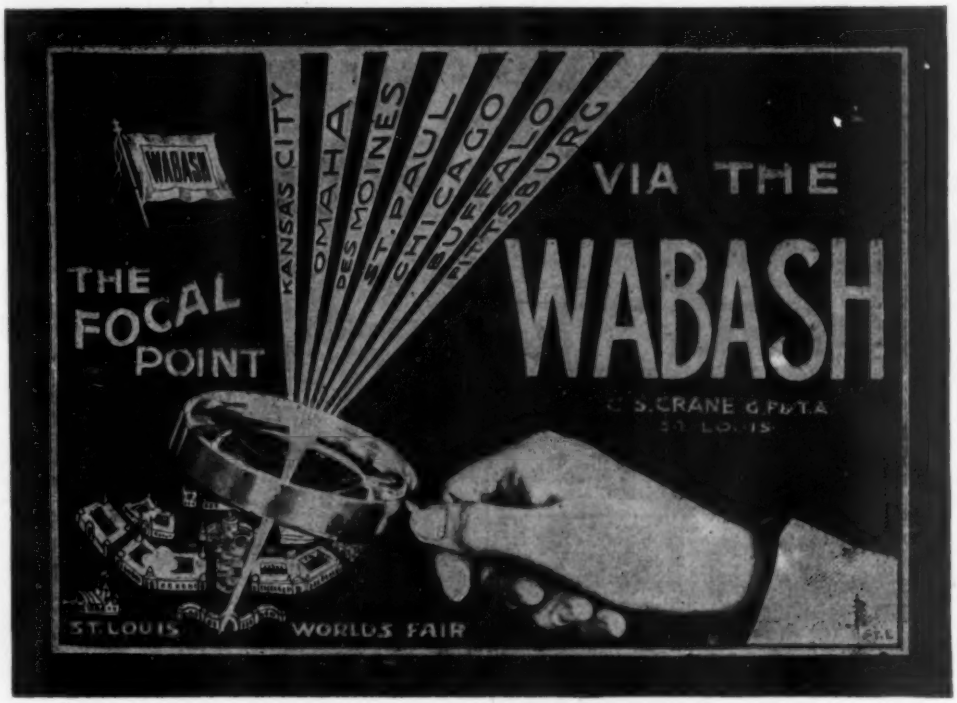

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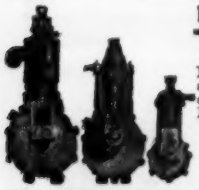

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Do it now!
If you're sure the job's your own,
Don't hem and haw and groan—
Do it now!

Don't put off a bit of work,
Do it now!
It doesn't pay to shirk,
Do it now!
If you want to fill a place
And be useful to the race,
Just get up and take a brace,
Do it now!

Don't linger by the way,
Do it now!
You'll lose if you delay,
Do it now!
If the other fellows wait,
Or postpone until it's late,
You hit up a faster gait—
Do it now!
—Frank Farrington.

BEAVERS' DAMS CAUSE DAMAGE TO BRIDGES.

Industrious beavers well protected by the game laws of the state of Montana are threatening the bridges across the streams. The animals construct dams of such strength and in such a systematic fashion that the rising waters threaten to wash away the bridges. It is said that they are causing much difficulty and destruction along the courses of irrigating streams.

GREAT LAKES HAVE THEIR FIRST WAR VESSEL.

A light unarmored cruiser with an armament of four 1-pounders will be the first Canadian war vessel to sail the waters of the Great Lakes. The vessel is being built by the Canadian government for the protection of fisheries on the Canadian shores of the Lakes and is to be equipped with a powerful searchlight which will be most vigilant.

The vessel will be 176 feet in length over all; beam, 22 feet; moulded depth from top of keel to top of deck beams, 14 feet; will have an 8-foot draught and be of 514 tons displacement. Her two triple expansion engines will drive two cast-iron 4-bladed propellers at 210 revolutions per minute. Steam will be furnished by two steel boilers of the Scotch type and her coal capacity will be 75 tons. Electric lights will be used throughout. The new cruiser is designed for a speed of 16 knots.

"POP" A FAMILY MAGAZINE.

Popular Mechanics:—I can say for your publication that it is the most interesting and instructive magazine I have ever read, and only wish it was a weekly instead of a monthly.

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Yours truly,
S. S. Mayfield, Waco, Tex.

PUTTING THE CANOE IN TRIM.

Before the canoe is used in the spring it should be gone over carefully and put in good order for the boating season. A neat-looking craft adds much to the enjoyment of the canoeing trip.

After a canoe has been used several seasons—three or four, says Sail and Sweep—it should be scraped on the outside with flat steel scrapers. Every inch of it should be scraped very carefully and, necessarily, slowly. The inside of the boat need not be scraped, but should be varnished a thin coat every third year. When all the varnish has been removed from the outside, go over it first with coarse sandpaper and then with finer. When this is done the pores of the wood will be filled with old oil and varnish, but the surface of the wood will be bare, hard and bright. Next give it a coat of linseed oil, let it dry well, and then fill all damaged places with hard wax. The paddles and deck and cockpit hatches should be treated in the same manner.

Varnish the canoe when the weather is warm enough for the varnish to set quickly, varnishing the hull and deck first and then the paddles, hatches, etc. Turn the canoe often during the day so it will dry evenly and be fairly hard by night fall. Use the best spar varnish, which should be thinned with plenty of turpentine, if used in the winter. Spar varnish is a good preservative for all high-grade woods.

After a week's interval give the canoe a second coat of varnish. If the glossy appearance is not desired, a duller finish may be had by rubbing, after the first coat is dry, with crude petroleum and pumice stone. Clean the wood, put on the second coat of varnish, and when that is dry rub lightly with crude petroleum, only.

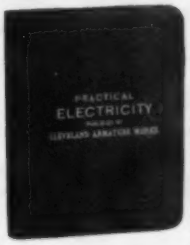
If metal fittings are to be cleaned at all rub them with emery cloth and clean thoroughly, but, as it is impossible in salt water to keep them in perfect condition, many canoeists allow them to corrode. In any case, after the canoe has been varnished and repaired, replace the fittings and rig up the craft for either sailing or paddling, as desired.

STEAM MOTOR LESS EXPENSIVE THAN HORSES.

A miller of Reading, England, has found that it costs him $681.31 less to use a 5-ton steam motor for carriage than the expense of seven horses kept in 1902 for the same purpose. The motor ran 5,272 miles, carried 3,870 tons and burned 41½ tons of coal, an expense of $1,849, including interest on the car and depreciation, whereas the expense for the horses had been $2,530.

GREENLAND'S ONLY NEWSPAPER.

The one newspaper in Greenland is printed at Gothaab, on the Northwest coast, every two weeks. It is called Atnagliuti (The Reader) and Lars Moeller is its editor. He began the paper twenty years ago, when it appeared only once in a while, as the editor would not print a new issue until he had sold all the copies of the last one. The paper was nearly all pictures, the cuts being crudely carved from rocks by Lars' own hands. The Reader's printing press and type were presented to him by Nordenskjold, the Swedish traveler. Under the cuts were printed the titles in the simplest Eskimo language. The few that could read explained them to the others. An ambition to learn to read the language was thus inculcated and in a few years Moeller was surrounded by a reading population of sufficient numbers to support his paper. Finally the editor began to print the prices of elderdown, skins, etc., and items of news gathered from various parts of Greenland. Now the inhabitants look for the paper anxiously and it wields considerable influence. Moeller has also published books devoted to the preservation of Eskimo fables and traditions.



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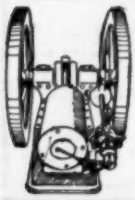

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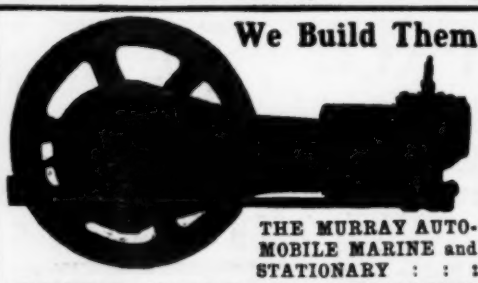

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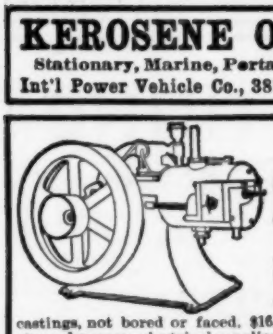

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GOVERNMENT CHEMISTS EXPERIMENT WITH HUMAN LIVES.

Cats, dogs and other such animals will no longer serve as subjects for experiments as to the effects of preservatives on the human system, say United States government officials. Human beings must be put to the test; they are constantly consuming foods containing these preservatives so the experiments, in fact, are but an exaggeration of common conditions. Therefore, the United States Bureau of Chemistry, of the Department of Agriculture, called for volunteers to sit at the govrnmental board for several months and partake of special rations.

The American citizen certainly has confidence in those in power and is not so wary of canned foods as many recent editorials would imply, for a great number of hungry men thronged in as applicants! Only 12 of the hollow-eyed victims could be accepted, however, and these were chosen in consideration of physical qualification. Persons who used alcoholic beverages at all were excluded entirely. Persons who used tobacco in moderate quantity were accepted, providing they pledged themselves to use it in regular quantities at specified hours, and did not change the brand during the six months they were subject to experimentation. Each young man further pledged himself to do ample justice to the good things the government placed before him for six months, spending, alternately, 10 days at the observation table, where the experimental food was provided, and 10 days at the recreation table, where the ordinary diet was resumed to assist the system to recover from any harmful effects sustained during the observation period. While attending the observation table they were pledged to use only the food and drink provided, excepting water, which, if used at other times, was to be measured and the quantity drank reported. Otherwise regular occupations were to be continued as before. If any of the chosen 12 died or sustained permanent injury during the period, the Department was not to be held liable.

The first of these experiments were with borax and boracic acid, increasing the quantity as the experiments progressed. To ascertain the results the food and drink were carefully measured according to their kinds, and a sample of each analyzed. Data concerning the excretory functions of the body was kept also and followed up with analytical study. The results of the observations and comparisons made showed that these preservatives, while not highly injurious, produce unfavorable conditions varying with individuals. The symptoms produced were feelings of depression and discomfort, with a dull headache and a sense of fullness in the head. In large quantities the preservatives produced nausea, vomiting and loss of appetite. The effects are of sufficient importance to warrant that notice of the use of these preservatives be required on the food product.

We would suggest that the stomachs of volunteers is not the proper field for reliable investigation. The stomachs of such individuals are too apt to be hardened to anything that comes their way. If the experiments are really important to the welfare of humanity, the subject for experimental purposes should be drafted in. They should be taken from the ranks of those who talk about mother's cooking, from the mansions of the rich, from football teams, and from the most usefully employed of the laboring classes. Let them draft in a few noted epicureans, even though they revolt; these are the stomachs that should ring true, and if preservatives undermine or disturb the health, these delicate "gastronometers" will surely indicate the fact.

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ELECTRIC HEADLIGHTS PREVENT ACCIDENTS.

Electric headlights for locomotives are highly commended by J. A. Carney, Master Mechanic of the Chicago, Burlington & Quincy railroad. Roads which have furnished their locomotives with these headlights have noticed a great decrease in the number of crossing accidents and Mr. Carney considers them of inestimable value in warning the public of the approach of high-speed trains.

SHE GUESSED THE SITUATION.

"It's so long since you last called upon me I was beginning to think you were forgetting me," said Miss Pechis, as she came down to the young man in the parlor.

"I'm for getting you," replied the ardent youth, "and it's for getting you that I've called tonight. May I have you?"

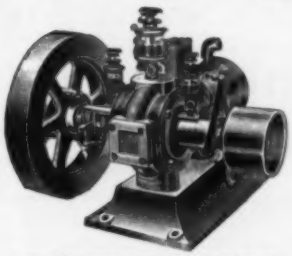
FACTS ABOUT STREET CAR LINES.

There are 16,648 miles of street and interurban car lines in the United States, or an average of about 17 miles of line to each of the 987 existing companies. These lines combined possess 60,290 passenger cars and carried 4,813,000,000 "fare" passengers and 1,063,000,000 transfer passengers, a total of 5,876,000,000 last year.

"PULL" CAUSED THE "IOWA" DISASTER.

Investigation of the explosion of the battleship Iowa's eight guns revealed that when the forgings for these guns were turned out the inspectors objected that they contained defects and sand cracks; that the manufacturers secured rehearings and resurveys until the forgings were finally accepted. The manufacturers did not like to lose the cost of the forgings which the gun factory inspectors rejected and they evidently had friends at court. That this is an isolated case a memory which goes back over ten years may have difficulty in believing. Wherever the fault, it is plain that the acceptance of defective material is a vice which makes our vast naval expenditure look like throwing away money.

SMALL GASOLINE ENGINES



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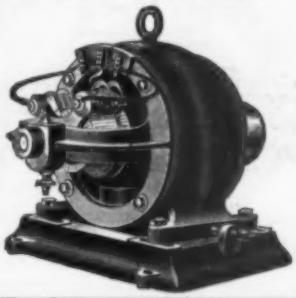

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NEW ELECTRIC DANGER SIGNAL.

A Californian has invented an electrical system for warning trains entering the zone already occupied by another train. The system lights an incandescent light right in the engineer's cab, where it could not possibly be obscured by fog or storm. The system involves a third rail in the center of the track for an electric current generated by a ⅓-horsepower dynamo located in the locomotive's cab and operated by its steam, contact with the rail being maintained by brushes underneath the engine. When two engines are on the same track within a distance of two miles of each other an alternating current will be created which will light the danger lamp in front of each engineer, the intensity of the light increasing the nearer the engines approach one another.

The device seems to be the best for its purpose yet invented and will probably be investigated by the many roads where life and property must be safeguarded.

AN ACETYLENE LIFE BELT.

A life belt which may be worn during an entire voyage without attracting notice and yet, if the person wearing it falls overboard, immediately expands four sacs with acetylene gas generated by a charge of carbide of calcium coming in relation with the water, has become a valuable feature of life-saving apparatus. The belt is called the Gros life belt and is composed of four flat, circular pouches connected by a tube. It passes under the arms and two pouches rest against the back; the other two, one on each side of the breast. A small metallic cylinder in each tube end contains the charge of carbide calcium which generates the gas which will keep a person floating head and shoulders above the water.

HOLE IN A LIFEBOAT.

One of the new lifeboats which is said to do good work has a hole in the bottom. The hole is not the result of accident, but is a feature of the boat's construction, and is for water to run out. The boat is described as consisting of two galvanized iron or steel concave shells, the smaller superimposed in such a manner that the concavities are uppermost, and leave a large air space between them. This air space is divided into twelve lateral, one forward, and one after water-tight compartments. In the very center of the boat is a longitudinal opening, which extends the whole length of the space intended for crew or passengers and is really a case for a center-board. It is much wider than necessary for that purpose and is intended partly to empty the boat and partly to hold a center-board consisting of thin sheet steel, weighted with a 600-pound bulb of molded lead. This center-board can be raised or lowered as in ordinary cases. The boats are fitted with oars and sails.

One was converted, during some experimentation, into an automobile lifeboat. It was furnished with a double-cylinder, 12-horsepower gasoline engine which gave a speed of 6 knots per hour.

The engine could not be reversed, so the propeller blades were reversed instead when necessary.

GREATEST INDEX IN THE WORLD.

A catalogue valuable to America is being compiled in London. It is an index of all the manuscripts in the possession of England, France, Holland and Spain which refer to the period of the American Revolution and covers a period from 1763 to 1783.

A United States dispatch agent, Benjamin Franklin Stevens, worked on the index for thirty years and left it nearly finished. There are entered in it 161,000 documents, arranged in three divisions. Fifty volumes of the manuscripts of the documnts as indicated by short titles, 100 volumes of chronological index with a description of each volume and its contents, and thirty volumes of alphabetical index, arranged from the names of the writers and receivers, or if no name is found, the subject. This makes 180 volumes in all.

Congress once considered making an appropriation for this work, but the effort came to naught. The index is valued at $100,000.

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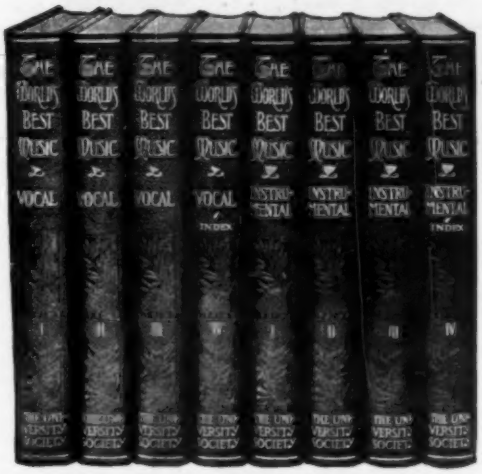

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HINTS FOR INVENTORS.

By Frederick Benjamin.
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IMPORTANT WARNING.

With each appearance of the list of patents in the Patent Office Gazette, patentees are beset with innumerable offers, solicitations, requests, etc., some pretending to want to purchase their patents, while others offer to take an interest in them under promise of procuring patents abroad.

One of the schemes often resorted to by these sharks is to invite patentees to join a fictitious association, under the pretext that by paying the membership fee the patented invention will be widely published in a paper which does not exist, and that they will thereby be rewarded by a sale of their inventions.

Have nothing to do with schemes that involve the payment of a fee for selling your patent unless you have carefully investigated the party and have reasonable assurance that you will get something for your money besides super-heated atmosphere.

SPECIAL INFORMATION FOR INVENTORS.

As soon as an application for patent is filed in the Patent Office the applicant is protected against the grant, without his knowledge, of a patent for the same thing to another person.

Citizens, foreigners, women, minors, and the administrators of estates of deceased inventors, may obtain patents. There is no distinction as to nativity or persons.

It is not necessary to work a United States Patent within any specified period in order to maintain its validity. The patent is granted for seventeen years, and remains valid for that period, whether it is worked or allowed to sleep. The 17 years' term of a patent cannot be extended except by a special act of Congress.

Two or more persons may apply jointly for a patent if they are joint inventors. Where one person is the inventor and the other only a partner, the patent must be applied for in the name of the inventor; but he may secure his partner in advance by executing a deed of conveyance, so drawn that the patent will be issued in both names.

SELLING PATENTS.

Assuming that your invention is new and useful, and that you have a good patent, or have applied for same, the following are the plans we recommend for disposing of the patent right under ordinary conditions:

1st. Have made a complete working model, or drawing of your invention in the best style you can afford. Show the model or drawings to your business acquaintances, and especially to those who are practical men and who are familiar with such inventions. Have them express in writing their opinions of your invention. Sell to these parties, if possible, a part interest in your patent with a view of securing their active co-operation in disposing of the entire patent to others who may be in better position to handle the article patented.

If one man is not able or willing to put up all the money required, get others to join him. It is often easier to get ten men to invest $100.00 each, than it is to get one man to invest $1,000.00.

Have the invention "written up" in an interesting way and published in a paper which reaches the class likely to be interested in such inventions.

2nd. If you can not sell your patent in your own city or locality, have made photographs of your model, or blue-prints of your drawings, and send them to manufacturers of such articles, with copies of the endorsements you have obtained for your invention, and ask the manufacturers to investigate the merits of the invention with a view of buying the patent right. Make your letters short and pointed, and use printed letter heads giving your name and address, the name, and an illustration of your invention. Do not claim extravagant things for it and do not ask a fabulous sum for the patent right. In fact, it is best not to name any price until you have interested the party.

3rd. If you cannot sell your patent by correspondence, take your patent and model and call on as many manufacturers in that line as you can; show them your model and point out the advantages of your invention. If they will not buy, but admit that the invention is good, ask them to put their opinions in writing so you can use them with the others.

4th. If you cannot afford to travel around to see manufacturers, send your model and a copy of your patent to some dealer in similar articles, who is located conveniently to the manufacturers, and offer him a liberal commission for making a sale of the patent for you.

5th. Offer to sell territorial rights for your invention rather than an undivided interest. It is better to sell the right for one or more states than to sell a one-tenth interest. If you can not dispose of the right for a state, offer it for one or more counties at a proportionate price. Every such sale will help you in disposing of other territory.

6th. If you cannot make a sale by any of the foregoing means, the chances are that your invention lacks merit. If, however, you can command capital sufficient to manufacture the articles, do so, and place them on sale with appropriate circular and newspaper advertising, offering them preferably through a jobbing house in that line. If your invention is of a character that needs to be tested before it can be appreciated, have the test made in your own locality first if possible. Do not be discouraged if success does not immediately follow your efforts. On the other hand, do not spend time and money on the invention against the advice and judgment of people who are in position to know more about such things than you are. Better abandon it and devote your energies to something else.

ABSTRACTS OF PATENT LAW DECISIONS.

A patent is prima facie evidence that the patentee was the first and original inventor.

The making of an invention is complete when all that remains to be done is the work of the mere mechanic.

When a man has conceived the main idea of an invention and employs another to embody it, the product will be the invention of the former, though the latter may furnish hints, suggestions and decided improvements, unless the changes made by the latter amount to a new and complete invention.

An inventor may avail himself of the services of skilled laborers, and suggestions and improvements coming from them are to be considered part and parcel of the original invention.

An employer engaged in working out a preconceived plan is entitled to make use of the auxiliary suggestions of the workman.

Trade-marks cannot be registered as labels.

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Joint owners of a patent right are not co-partners, and in the absence of any express contract, each is at liberty to use his moiety as he may think fit, without any liability to, or accounting to the other for profits or losses.

Patent rights are co-extensive with the United States, and are not subject to seizure and sale on execution.

The manufacturer of a patented article can continue to affix to it the word "Patented" and the date, even after the patent has expired, without liability, under section 4901.

Owners of a patent are tenants in common and each, as an incident of his ownership, has the right to use the patent or to manufacture under it. But neither can be compelled by his co-owner to join in such use or work, or be liable for the losses which may occur, or to account for the profits which may arise from such use.

One of joint inventors may lawfuly file a caveat on the joint invention.

If a new combination and arrangement of old elements produce a new and beneficial result never attained before, it is evidence of invention.

A mere aggregation of old things is not patentable, and in the sense of the patent law, is not a combination. In a combination the elemental parts must be so united that they will dependently cooperate and produce some new and useful result.

The application of an old device to a new purpose, simply analogous to its purpose, is mere double use.

An old construction in a windmill is not patentable in a paddle-wheel.

An employer is not entitled to any knowledge of the independent inventions of his employe.

As between an employer and an employe, not specially employed to embody the invention of the former, there is no presumption of originality in favor of the employer.

State courts have no jurisdiction of suit for infringement, but are not barred out when patents come in collaterally.

To make experiments, then drop them and only recur to them when another and later inventor has made a success of the idea, makes them "abandoned experiments."

Abandonment of an invention once put in public use inures to the public; a subsequent inventor cannot take a patent therefor.

Alterations cannot be made in pending applications which go outside the original record and model.

An article of manufacture old as to form and general appearance, may have intrinsic qualities due to the process of its manufacture which makes a new and patentable product.

A patent right, like any other personal property, is understood by Congress to invest in the executors and administrators of the patentee, if he dies without having assigned it.

If an employe makes an invention and permits his employer to use it before making application for a patent without demanding any compensation, a license to continue the use may be implied.

Every person who pays the patentee for a license to use his process becomes the owner of the product, and may sell it to whom he pleases or apply it to any purposes, unless he binds himself by covenants to restrict his right of making and vending certain articles that may interfere with the special business of some other licensee.

A "shop right" is a personal license and is not assignable.

A purchaser of patented articles from a territorial assignee does not acquire the right to sell the article in the course of trade outside the territory granted the vendor.

A territorial grantee cannot be restained from advertising and selling within his territory, even

entable.

though the purchasers may take the patented article outside of the vendor's territory.

Although an assignment of patent is not recorded within three months, it is binding on the assignor, and he cannot sell it again.

Perpetual motion devices will not be patented.

HOW MATCHES WERE ONCE MANUFACTURED.

The idea of matches was first evolved in the mind of a mariner watching the phosphorescent light upon the sea. The first efficient matches, however, were put upon the market in boxes of two dozen at a shilling a box by John Walker, of England, in 1827; they were called Congreves. Each match had to be drawn through a piece of sand paper to be ignited. For many years matches were made entirely by hand labor, each splint being dipped separately; later, they were tied in bundles and dipped. Still later, the splints were fixed in a frame which held each one separate from the others, and the frame was then brought down on a marble slab covered with the ignition composition, and in this manner about 1,500 were made at a time.

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PICKING UP A CABLE IN THE AMAZON.

While mending a fault in one of the cables in the Amazon river, a short time ago, the cable ship "Viking" had some unusual experiences.

The fault was localized, but the cable could not be grappled at the spot so the ship moved down stream a mile and there succeeded in hooking it. It was lifted and cut, one end was buoyed, and the ship started picking up towards the fault. A half mile up the course of the cable led in among the coarse grass, or capim. Here there was 12 feet of water and as the ship required but 10 feet to float her, the picking up was continued in the hope of forcing a way through the obstruction.

The work was carried on with great difficulty; grass choked the pumps, and water for the boilers had to be supplied by means of a section hose put over the side and connected to a hand pump. Finally it was necessary to clear the way by the use of knives, choppers, etc. A little farther on the water measured but nine feet and so the cable was cut and part of it abandoned. The channel of the river had changed and where the cable was laid about five years before is now an island overgrown with young trees and burying a length of the cable.

The ship was pulled forward by means of the cable; to pull her back Kedge anchors were run out, but did not hold. Grapnels were then used with the anchors, but did not avail to move her. Finally grapnels were run out over the bow and carried along the grass to the stern of the ship and hooked deeply into the obstruction which was then pulled forward with the winch. By repeating this operation several times, an 8-foot snake being killed in the meantime, the ship was moved. The propeller and choked pumps had to be cleared of grass before it could resume the work and complete the repair.

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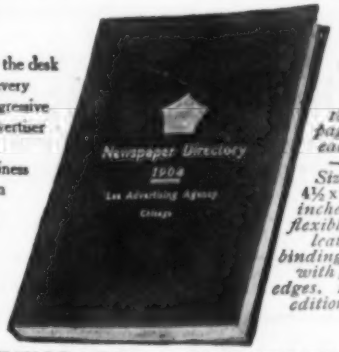

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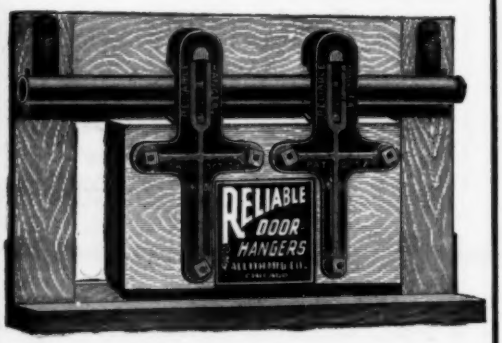

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An English railroad company has undertaken to deliver produce directly from the producer to the consumer. Lists of the names and addresses of producers are distributed in cities along the road and residents there can have any quantity of produce desired sent on the fast passenger trains. The company provides boxes for shipping the produce at small cost. The freight rate for 24 pounds is: 50 miles, 12 cents; 100 miles, 18 cents; 200 miles, 24 cents; any distance over 200 miles, 30 cents straight.

This plan will stimulate home produce trade and Britain will be independent of importation in these lines from the Continent.

PETRIFIED MILK.

In Austria 20,000 quarts of skimmed milk are converted into petrified milk daily, reports United States Consul-General Guenther of Frankfort, Germany. A chemical process precipitates the casein in the milk in the form of a yellowish brown powder. This is mixed with formalin and a horn-like product called milk-stone results. This is used with various admixtures as a substitute for horn, turtle-shell, ivory, celluloid, marble, amber and hard rubber. Handles for knives and forks, paper cutters, crayons, pipes, cigar holders, seals, marble, stone ornaments and billiard balls are now made of skimmed milk. The stone is a valuable by-product of the dairy as galalith is insoluble, elastic and fireproof and for these reasons is apt to find a good market.

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The Only Successful Weaner in the World

Guaranteed Not to Make the Nose Sore

Guaranteed to keep any cow from milking herself, no matter how much she has been spoiled by other means, or whether she lies down or stands up.

No. 0 for Calf or Colt 1 day to 4 months old, with Halters, complete..... 35c
No. 1 for Small Calf or Colt 1 day to 12 months old, with Halters, complete 50c
No. 2 for 2-year-old or Jersey Cow, with Halters.. 65c
No. 3 for big Cow or Horse, with Halters..... 75c

The two small sizes are the best and handiest dog muzzles. Sent express prepaid on receipt of price.

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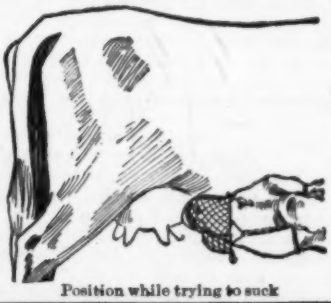
Position while eating



Position while trying to suck

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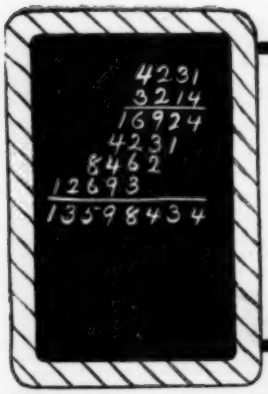

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THE WESTERNER'S LAMENT.

Th' city's no place fer a feller who's used to th' life of th' camp,
Layin' down with th' stars for companions by th' light o' th' heaven's great lamp;
With th' smell o' th' hoss-mint an' roses from th' canyons so wide an' so deep,
Where th' crick's talkin' sweet to th' willers an' rockin' th' lillies to sleep;
Where th' whip-o-wills call to th' night time an' th' wind sighs soft thro' th' pines,
An' talks to itself in th' clover or stirs in th' raspberry vines,
Or kisses th' tips of th' foxglove or down in th' dusk an' th' gloom.
A-wooin' with tender caressin' th' dark little violet's bloom.

Th' city's no place fer a feller whose heart is built on th' plan
Of freedom from styles and from fashion like th' heart of a natural man;
Whose hand's ever out to th' stranger, whose home is his while he stays,
Who's tryin' to be a straightforward man in these coin-chasing days.
Th' city's no place fer a feller who's pillowed his head on th' sod,
Alone with th' stars fer companions, alone with himself an' his God;
Alone where th' stream tells a story to th' canyon so wide an' so deep,
Alone where th' voices of nature sing his heart an' its troubles to sleep.

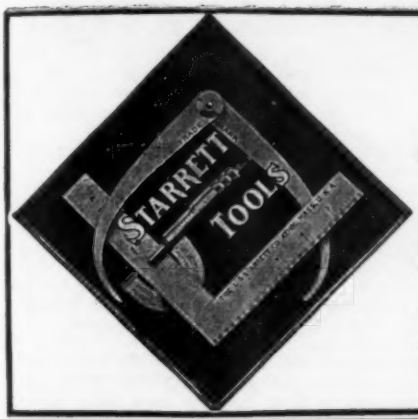
—ROBERT V. CARR.

MAY MEND THE OLD LIBERTY BELL.

The old Liberty bell may sometime peal anew with the same tone as when it rang out our Independence.

In Germany many bells have been successfully mended by a Swedish family named Olson who keep their process a profound secret, and wherever they work they require the authorities to guard them from intrusion during their operations which are usually performed in a large field, fenced in by canvas. It is believed that in their method the bell is encased inside and outside in a plaster of Paris cast, leaving the crack open. The composition of the bell is duplicated and poured into the crack, closing it perfectly and then the clapper is hung to strike in a different spot.

The proposition of mending our own historic bell is to be brought before Congress. Meanwhile it is on exhibition for the patriotic and the curious at the St. Louis World's Fair, but it is doubted that our patriotism will ever ebb so low as to permit the national irreverence of having it mended.



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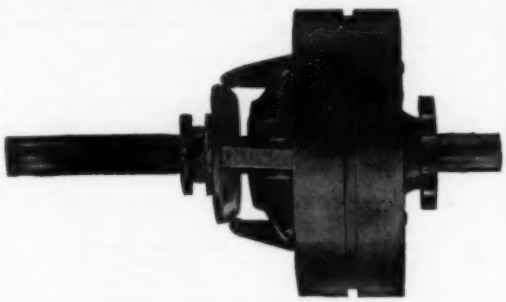

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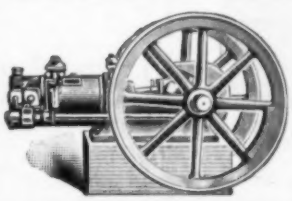

Our friends will find at the space good drinking water, electric fans, comfortable chairs and writing materials. Visit us, see our exhibit and test our hospitality.

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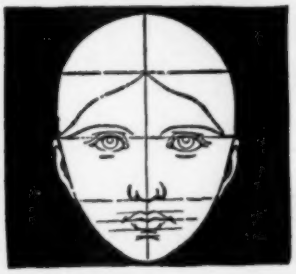

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OYSTER EATS AT ALL TIMES.

The oyster keeps its mouth open always and constantly receives food into it. However, this is due to its organism rather than to greed. Dr. W. K. Brooks in a book on the oyster tells how it feeds:

"The surface of the gills is covered by an adhesive excretion for entangling the miscroscopic organisms contained in the water, and as this circulates over and through the gills they stick fast like flies on flypaper. The hairs which drive the water through the gills push the slime, with the food which has become entangled in it, toward the mouth, which is well up toward the hinge; for it is hardly necessary to say that what the oystermen call the mouth is only the opening between the halves of the mantle.

"On each side of the mouth there is a pair of fleshy organs called the lips, although they are more like mustaches than lips, for they hang down on each side of the mouth. One on the right is joined to one on the left, above the mouth, while the other two are joined below it, so that the mouth itself lies in a deep groove or slit between the lips.

"The ends of the gills fit into this groove, and as the hairs slide the food forward it slips at last between the lips and slides into the mouth. This process goes on whenever the oyster is breathing and the oyster's stomach is usually well filled."

TRICKS OF SAILORS.

On board ship fresh or soft water is only issued at certain hours. There is then a general scramble for buckets which are not numerous enough for the demand. Some of the older salts who, from force of habit, think they own the bucket, bore a hole in the bottom and cut it square or diamond shape and then whittle out a plug to fit the hole. When the bucket is not in use he carries the plug in his pocket. Should any other salt get his bucket he is not long in finding it, and issuing a challenge to the party having it to come forward in the forecastle (pronounced' fokersal) and fight it out before all hands.

SHIP LOCOMOTIVES TO JAPAN.

Twenty-four locomotives hurriedly built in Philadelphia for the Japanese government have been shipped to the far east. The utmost secrecy was maintained in shipping the engines to prevent their falling into the hands of the Russians.

They tell of a Chicago physician who, opening the door of his consultation room, asked: "Who has been waiting the longest?"

A tailor who had called to present his bill, rose and said: "I have, doctor; I delivered your clothes to you three years ago."

DEEPEST HOLE IN THE WORLD.

The deepest hole in the world was bored by the Prussian government to test for the presence of coal. It is 4,560 feet deep, 11 inches wide at the top, and 2 inches at the bottom where the temperature is 118 degrees Fahr. It cost $25,000 and required 3½ years to bore it.

The old Irish potato's days are numbered, for a potato called the Uruguay Irish potato is rapidly supplanting it. This potato is said to be of enormous size and immune from disease. The French are beginning to cultivate it.

YOU CANNOT "MAKE BRICKS WITHOUT STRAW" BUT YOU CAN SECURE ANY OF THESE

High Grade Tools Without Money

The following carefully selected list of tools includes those which every mechanic needs, and which everyone who engages in mechanical work as a recreation will greatly desire to possess. We have selected a well-known brand, the excellence of which for quality and accuracy is beyond criticism. They are all from the celebrated works of the L. S. Starrett Company, manufacturers of fine mechanical tools. Every tool in these lists can be easily earned by securing a small club of new yearly subscribers to Popular Mechanics;

ANY TOOL IN THIS LIST FOR ONE NEW SUBSCRIBER

		Retail Price.
No. 303	4-in. Spring Tempered Rule	$ .45
No. 403	4-in. Beveled Edge Rule	.45
No. 330	4-in. Narrow Hook Rule	.45
No. 391	Spring Tempered Center Gage	.45
No. 450	Folding Pocket Rule in case	.50
No. 135	Nickel Plated Pocket Level	.50

ANY TOOL IN THIS LIST FOR TWO NEW SUBSCRIBERS

No. 303	Spring Tempered Rule, 9-in	1.00
No. 403	Beveled Edge Rule, 9 in	1.00
No. 420	Hook Rule, 6 in	1.00
No. 21	Thin Straight Try Square, 2 in.	1.00
No. 125	Adjustable Caliper Gage, 2½-in	1.00
No. 193	Protractor	1.00
No. 40	Screw Pitch Gage	1.00
No. 172	Thickness Gage	1.00
No. 87	Mercury Plumb Bob	1.00
No. 146	Adjustable Hack Saw Frame and Blade	1.00
No. 104	Speed Indicator	1.00
One Dozen No. 116 Asst. Nail Sets, in case		1.15

ANY TOOL IN THIS LIST FOR THREE NAMES EACH

ANY TOOL IN LIST 1 AND LIST 2, OR,

No. 405	Patent Draftsman's Scale, 12 in	$1.50
No. 380	Steel Straight Edge, 18 in	1.80
No. 11	12-in. Combination Square	2.00
No. 60	6-in. Reliable Try Square	1.25
No. 425	Slide Caliper Rule, 3 in	2.00
No. 15	3-in. Universal Bevel	1.50
No. 6	Screw Pitch Gage	1.50
No. 36 or 37	6-in. Lock Joint Transfer Calipers	1.50
No. 186	Drill and Steel Wire Gage	1.50
No. 132	6-in. Level	1.50

TOOLS IN THIS LIST FOR FIVE NAMES EACH

ANY TOOL IN LIST 2 AND LIST 3, OR

No. 380	24-in. Straight Edge	$2.40
No. 510	Steel Tape in Leather Case, 50 in	4.00
No. 9	12-in. Combination Square Set	4.00
No. 33	Hardened Steel Combination Squares, Drop Forged	3.00
No. 20	4½-in. Hardened Edge Solid Steel Square	3.50
No. 25	4-in. Caliper Square with Adjustable Screw	4.00
No. 66	Locomotive Guide Liner	3.00
No. 57	New Universal Surface Gage, 12 in	3.00
No. 97	12-in. Improved Level for Testing Shafting	2.50
No. 197	12-in. Electrician's Level Non-Magnetic	3.50
No. 163	24-in. Draughtsmen's T. Square	3.50

TOOLS IN THIS LIST FOR TEN NAMES EACH

ANY TOOL IN LIST 1 AND LIST 5, OR,

No. 3	1-in. Micrometer in Case	$6.50
No. 113	1-in. Micrometer in Case	7.50
No. 2	2-in. Micrometer in Case	7.25
No. 124	B. Inside Micrometer	6.25
No. 300	Universal Bevel Protractor	5.75
No. 196	Universal Dial Test Indicator with Tool Post	7.50

Any tool in the Starrett Catalog desired, and not given above, will be given as a premium for a club. ∴ ∴ For particulars address

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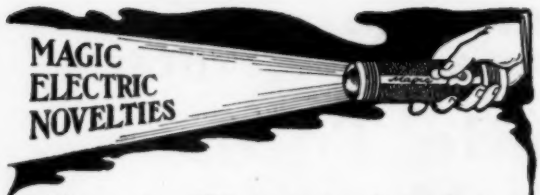

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Fan Motors, $2.00 to	$15.00
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Electric Door Bells,	1.00
Electric Carriage Lamps,	5.00
Hylo Turn-Down Lamps,	.60
$8 Medical Batteries,	3.95
$12 Belt, with Suspensary,	2 50
Telegraph Outfits,	2.00
Battery Motors, $1.00 to	12.00
Bicycle Electric Lights, $2 to	3.50
Electric Railway,	3.25
Pocket Flash Lights,	1.25
Necktie Lights,	1.00

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$3 Electric Hand Lantern. Agents wanted.

OHIO ELECTRIC WORKS, .. Cleveland, Ohio

A NIGHT RIDE ON THE LIMITED.

A quiver of steam in the station's hum,
A long, black monster standing dumb.

A steady pull at lever and cord,
A sharp, clear cry of "all aboard,"
And the tardy passenger rushes pell-mell
At the warning of whistle and clanging of bell!
Chug, chug—swish, swish! With avalanche force
Moves the mountain of metal, this steel-ribbed horse,
Outstripping the wind in a merry race,
While a specter floats in its erstwhile place.

A dazzle like daylight ahead on the track—
A flame starred midnight hurtling back!
Here flits a freight-house, silent and grim,
A puffing yard-engine, with headlight dim,
A switch-tender's cabin, a siding of cars—
A lightning express seems to plunge from the stars
And is gone; a single, hoarse cry
Gives us greeting of how d'ye do and good-bye!

Now a glimpse of the river, a clattering bridge,
A loud-roaring forest, a pine-crested ridge—
Farm houses, rail fences, a lone country maid,
All aflutter at a crossing and seems half afraid;
Wide-spreading meadows and moon-silvered corn,
And drooping buds 'waiting the breath of the morn,
Then neatly-hedged gardens and cottages trim,
And village church sounding with evening hymn!

A hound held in leash by a hand of steel,
A chariot gliding on magic wheel,
A leviathan sporting on billows of steam,
A demon that sweeps through your midnight dream!
Chug, chug—swish, swish! With lessening roar,
And fitful flash from the furnace door;
While wailing whistle and clanging bell
Awaken the echoes of valley and dell!

A quiver of steam in the station's hum,
A long, black monster standing dumb!

RAPID JUSTICE BY TELEPHONE.

It cost Alexander Robinson, of Indianapolis, $10 to answer a local telephone call. When he put the receiver to his ear he heard this:

"Hello, is this Alex. Robinson?"

"Yes, this is Robinson. Who wants me?"

"I do. I am Justice of the Peace Smock."

"Well, what do you want, Squire?"

"I've got a complaint against you for having a seine net in your possession. Are you guilty or not guilty?"

"Guilty, Squire, but what in the——"

"Guilty, are you? Well, I fine you five dollars and costs," and the Squire hung up the receiver, while Alex. used "hello" and other words.

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